No 2685 VOLUME 78 FRIDAY 26 AUGUST 1960

FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded 1909

Editor-in-Chief
MAURICE A. SMITH DFC

Editor
H. F. KING MBE

Technical Editor
W. T. GUNSTON

Production Editor
ROY CASEY

IN THIS ISSUE

From All Quarters 286
Vickers' Hovercraft: First Details 287
Missiles and Spaceflight 289
Had I but Wings... 293
Flight System Survey 297
Canadair CL-44-6 298
Jet Noise and Society 299
Airline Fares 303
Panamerama 304
US Election-year Policies 305
Straight and Level 307
Service Aviation 308
Air Commerce 309
Ladies' Day at Thruxton 314
Correspondence 315
The Industry 316

Iliffe & Sons Ltd, Dorset House, Stamford Street, London SE1; telephone Waterloo 3333. Telegrams Flightpres Sedist London. Annual subscriptions: Home £4 15s. Overseas £5. Canada and USA $15.00. Second Class Mail privileges authorized at New York, NY.

Branch Offices Coventry: 8-10 Corporation Street; telephone Coventry 25210. Birmingham: King Edward House, New Street, 2; telephone Midland 7191. Manchester: 260 Deansgate, 3; telephone Blackfriars 4412 or Deansgate 3595. Glasgow: 62 Buchanan Street, C.1; telephone Central 1265-6.

New York, NY: Thomas Skinner & Co (Publishers) Ltd, 111 Broadway, 6; telephone Digby 9-1197.

© Iliffe & Sons Ltd, 1960. Permission to reproduce illustrations and letterpress can be granted only under written agreement. Brief extracts or comments may be made with due acknowledgement.

Jet Noise and Society

ENTITLED as above is an article in this issue (pages 299-302). We believe it has an uncommon significance, because it bears directly upon the life of great communities. The author concludes: "The public wants to know what is being done to protect family life from disruption by the greatest noise that our commercial civilization has ever produced, and to which society may not become tolerant, in the medical sense, as it did to the products of the Industrial Revolution."

This argument for fuller information is not based solely on the "right to know" of a democratic nation (undeniable though that right is). It is in aviation's interest that an increasingly hostile public be vouchsafed, rather than have to seek—often without success—full information about the battle to control jet noise that is being waged on its behalf by the airlines and by the Ministry.

Frank information may sometimes get distorted or misrepresented by the Press, to the disillusionment of its suppliers. But this is no argument for suppression, which makes a subject "news" and leads to greater distortions. The goodwill engendered by frankness must in the long term outweigh the abuses of frankness—especially since a positive campaign of full information will inevitably assuage resentment among a public that feels it is being sacrificed to a privileged industry—and being deceived into the bargain. People who feel that they are being deceived will put up with far less noise than people to whom it is made evident that their interests are being cared for.

Full information, the new Minister will find, will prove to be a valuable ally in the solution of a difficult social problem. It is an ally worth enlisting—in the public interest, and hence in the airlines' interest.

One Man Apart

A YEAR or two ago we wrote on this page about "the man apart"—the man of ideas, the genius. "He is hard to find," we said, "though he moves among us still. In him lies our highest hope for the future. The groups can never displace him. At best they may be the means of serving him."

Just such a man is the chief scientist to Rolls-Royce Ltd, Dr A. A. Griffith, CBE, DEng, FRS, of whose retirement we learn with regret. It is said of him by a colleague, the company's technical director, that he was very little known to most people within Rolls-Royce; yet in the 21 years he spent with the company he exerted a great influence on its work. The name of Griffith may yet resound in aeronautical history, not so much, perhaps, for his 1926 proposal of an axial-compressor gas turbine for aircraft, nor yet for his memorandum of 1945 which was the basis of the world-renowned Avon. His greatest attainment may yet prove to be his concept of the revolutionary jet-lift principle for vertical take-off. He foretold this development as long ago as 1941, and it has now been realized in the Rolls-Royce Flying Bedstead and Short SC.1. Thus Britain goes forward into the supersonic era with a unique experience founded on one man's ideas.

They say at Rolls-Royce that Dr Griffith's staff had to mark the telephone cables with sheets of paper in order to prevent his walking into them in his concentration. Our own belief is that he was really able to see quite clearly where he was going. Given a few more men of his talent and disposition, the future of our industry and of the British nation would be assured.

FROM ALL QUARTERS

RUSSIAN RETICENCE: The familiar Soviet tendency not to talk in advance about space achievements was demonstrated professionally at a Stockholm press conference on the subject of Sputnik 5 on August 19 by Professors Anatole Blagonravov (centre, talking to interpreter) and Leonid Sedov (right). See news item immediately below

"Flight" photograph

Recovery from Orbit (1)

THE most significant step forward in the development of manned spaceflight to date was the successful recovery on August 20 of the Russian Earth satellite, a replica of Sputnik 4 weighing 4,600kg (10,140lb) and containing two dogs, rats and mice. This was the first announced Soviet success in recovering any object from orbit, and the first in which living beings have been recovered safely after orbital flight. Both the Russians and Americans had previously recovered animals safely after ballistic flights, and the United States had previously recovered a satellite capsule, Discoverer 13, from orbit.

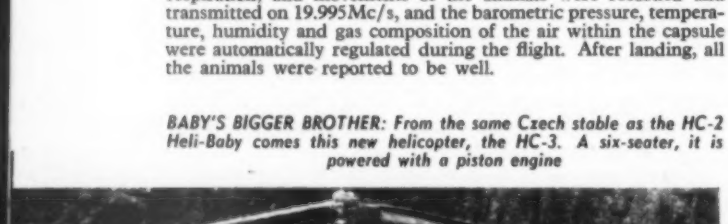
The launching of the Soviet satellite was made on August 19. At the International Astronautical Congress in Stockholm a press conference was hurriedly arranged with Professors Leonid Sedov and Anatole Blagonravov, who declined to give any significant details of the attempt or to assess in advance their chances of a successful recovery. Somehow the orbital height of 320km and the angle of inclination of 65deg slipped out in spite of the professors' best efforts.

Prof Blagonravov said that the animals aboard the satellite were being "watched by means of television," and implied that environmental conditions in the capsule were being controlled from the Earth. Was an overland or sea recovery planned? "Both are possible," came the bland reply. What would be the lifetime of the satellite? "The lifetime will be determined by the course of experiment." How much food did the two dogs have? "The amount of food is adequate for the purpose of the experiment, plus a small reserve."

The real news came the next day. The separation and re-entry sequence had been initiated on the satellite's 18th orbit, whereupon "the guidance system and braking device functioned with great precision and ensured the descent of the ship in the prescribed area," according to the official Tass announcement. The landing point was said to be within 10km of that selected in advance, and the animals accompanying the dogs Belka and Strelka were identified as rats and mice, plus other living organisms in the form of flies, plants, fungi, microscopic water plants and seeds, included in a study of the effects of cosmic radiation.

The instruments registering the basic physiological functions of the animals were said to have worked "with sufficient accuracy." The heart tones, blood pressure, frequency and character of respiration, and movements of the animals were recorded and transmitted on 19.995Mc/s, and the barometric pressure, temperature, humidity and gas composition of the air within the capsule were automatically regulated during the flight. After landing, all the animals were reported to be well.

BABY'S BIGGER BROTHER: From the same Czech stable as the HC-2 Heli-Baby comes this new helicopter, the HC-3. A six-seater, it is powered with a piston engine



Recovery from Orbit (2)

OVERSHADOWED by the recovery of the 4½-ton Soviet animal-carrying satellite, the successful aerial recovery of the 85lb instrument capsule of Discoverer 14 on August 19 was nonetheless an impressive achievement. This was the second Discoverer capsule to have been succesfully recovered after orbital flight.

Discoverer 14 was launched from Vandenberg on August 18 by Thor-Agena-A, and re-entry was initiated on the satellite's 17th orbit. At a height of about 10,000ft some 300 miles north-west of Hawaii the re-entry capsule was "snatched," as it descended by parachute, by a "trapeze" towed behind a C-119 aircraft.

Prime contractor for the USAF Discoverer programme is Lockheed Aircraft Company, whose subcontractor for the re-entry capsule is the General Electric Company. A photograph of an identical Discoverer capsule exhibited at the International Astronautical Congress in Stockholm appears on page 290.

The U-2 Trial

IN Moscow last Friday, Francis Gary Powers, the American pilot charged with making an espionage flight over the Soviet Union, was sentenced to ten years' imprisonment, after pleading guilty to the accusation. The first three years of his sentence are to be spent in gaol, with "detention" to follow. Powers fell into Russian hands on May 1, when the Lockheed U-2 which he was flying from Peshawar in Pakistan to Bodø in Norway was shot down by a ground-to-air rocket at a height of 68,000ft—which the Americans have disputed, advancing the theory that a flame-out or other engine trouble was initially responsible for Powers' descent, whether or not his aircraft was eventually shot down. During the three-day trial a number of points of technical interest concerning the U-2 and its equipment came to light, and these are noted in detail on page 288.

Lord Weeks

WE record with regret that Lord Weeks, formerly chairman of Vickers Ltd (from 1949 until his retirement in 1956), died in hospital last Friday at the age of 69 after a short illness. The period of his chairmanship was marked by considerable aviation progress in the Vickers Group, the Valiant, Viscount and Scimitar being developed and the Vanguard projected. After his retirement as chairman, Lord Weeks remained a director of Vickers Ltd.

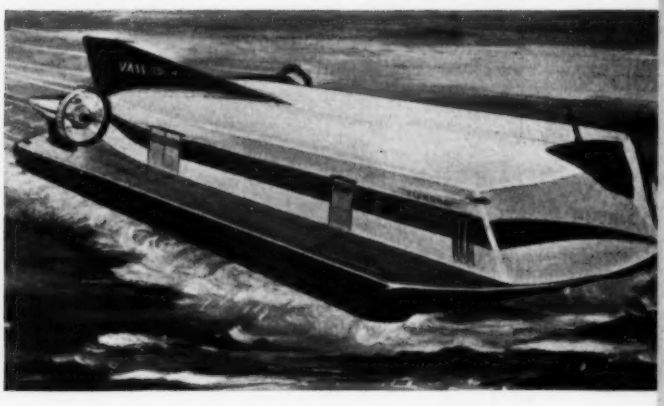
Twenty-mile Parachute Drop

ON August 16, over the White Sands proving ground in New Mexico, Capt Joseph Kittinger, USAF, made a remarkable parachute descent from a free balloon. He jumped at an altitude of nearly 20 miles and pulled his rip-cord at 17,500ft after falling for 4min 38sec. In his fall he attained a speed of 614 m.p.h. or nearly Mach 1. Reports about the maximum height differ, but it is thought that Kittinger may have exceeded the world's record of 102,500ft established by Lt-Col David Simons, USAF, in 1957. Certainly he surpassed the greatest height ever reached in a manned balloon with an open (i.e., unpressurized) gondola.

Good News for Australians

APPOINTMENT of Mr Henry Millicer as chief designer to Victa Consolidated Industries in Sydney has been described by a correspondent as "the biggest news in the modern history of light aircraft in Australia." By the appointment, Victa have undertaken to build a minimum of fifty Millicer Tourers, which will be offered at cost price to the Australian aero clubs. The prototype Tourer has been flying with a 65 h.p. engine; production models are to have the 95 h.p. Continental C-90 or 100 h.p. A-200.

OBSERVER: The bulky appendage to this Beech RL-23D is a side-looking airborne radar (SLAR) for battlefield surveillance. The aircraft was one of several displayed by the US Army at Odiham last week



HOVERCRAFTSMANSHIP: (Left) Vickers' high-speed hovercraft launch and trials vehicle with an operating payload of up to 4,000lb dependent on powerplant installation. (Right) Proposal for a hovercraft of over 70 tons to operate as a passenger or freight vehicle. A payload of 250 passengers or 25 tons of freight would be carried at 80kt

IN BRIEF

The world's first nuclear-powered aircraft carrier, *Enterprise*, is to be launched at Newport News, Va, on September 23.

Electric Autolite Co and Hiller Aircraft Corporation have signed a merger agreement, and approval is shortly to be sought from stockholders.

The name Buccaneer has been mentioned for the NA.39 strike aircraft. Neither the Admiralty nor Blackburn Aircraft, however, have made any official announcement.

Fashion-note for Farnborough: on the Avro Vulcan B.2 the dark blue used in RAF roundels has given way to a sky-blue colour, and serial numbers will be in the same shade.

A complete engine test plant for post-overhaul testing of Rolls-Royce Darts is being supplied to Hindustan Aircraft Ltd of Bangalore by Heenan & Froude Ltd, Worcester.

RAF exhibits at the Radio Show (Earls Court, London, until September 23) include an automatic landing system, long-range surveillance ground radar and airborne weather radar.

Prof A. G. Smith, Professor of Aircraft Propulsion at the College of Aeronautics, Cranfield, has been elected as the first holder of the Hives Chair of Thermodynamics, endowed by Rolls-Royce Ltd, at Nottingham University.

D.H. Propellers Ltd have received a contract for propeller equipment for the prototype Breguet 1150 Atlantic (two Rolls-Royce Tynes). The propellers are 16ft in diameter, with four aluminium alloy blades. Among their operating features is Beta control.

Two Westland Whirlwind Series 2 helicopters (750 b.h.p. Alvis Leonides) were handed over to Lt-Col Abdullah Bitar, Jordanian Military and Air Attaché, at Yeovil on August 11. They are being dismantled and shipped to Jordan, where they will go into service with the Royal Jordanian Air Force.

Vickers-Armstrongs (Aircraft) Ltd announce the appointment of Mr L. F. Trueman, AACCA, as secretary. He joined the company in 1955 and was appointed financial accountant in July last year. Mr F. S. King, JP, who joined in 1935 and has been chief accountant at the Weybridge works since 1956, has been appointed chief accountant of the company.

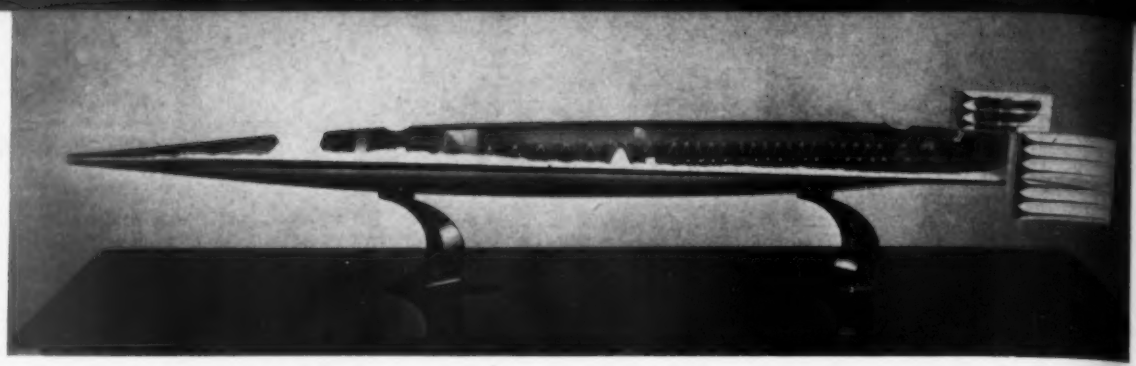
On August 22 the USAF announced a research contract with the Northrop Corporation for a laminar-flow system. The work is expected to cost at least $20m over three years, to involve two prototypes and be concerned with a system of sucking air through thin spanwise slits. Handley Page have been strongly advocating drag-reduction by such means since 1949.

Purchase by Bristol Aero-Industries of the old-established Vancouver helicopter operators, Okanagan Helicopters, was taken a stage further last Saturday, when Okanagan shareholders approved the sale for $4,061,589. Completion is now only dependent on approval by the Air Transport Board and the Department of Transport, and on the arrangement of satisfactory financing. Bristol Aero-Industries is a subsidiary of the Bristol Aeroplane Co of Canada Ltd.

(Further "From all Quarters" news will be found overleaf)

"PEACE AND FRIENDSHIP": The Russian and British teams competing in the World Parachuting Championships at Sofia exchange pennants. The story of the event, told by the British team captain, appears on pages 293-296 of this issue

FLAPS AND FANS: the port powerplants and outboard leading-edge flap of the converted Boeing 707-120B of American Airlines, described in "Flight" last week. It is now learned that the Pratt & Whitney JT3D-1 turbofan installed in the "B" members of the 707 and 720 family does in fact have a reverser for the hot jet



FORMULA FOR THE FUTURE? In model form is seen the newest version of the Griffith supersonic VTO airliner, with shock-body in the extended nose. Dr A. A. Griffith—whose retirement from Rolls-Royce is announced below—originally conceived the project ten years ago

FROM ALL QUARTERS . . .

Dr Griffith Retires

AFTER 21 years' service with Rolls-Royce Ltd, Dr A. A. Griffith, CBE, DEng, FRS, chief scientist to the company, has retired. He will continue as a consultant.

The following are extracts from an appreciation written by Dr Griffith's colleague, Mr A. A. Rubbra, technical director of Rolls-Royce (the two men have more in common than their initials): "From very early in his career Dr Griffith was an advocate of the gas turbine engine for aircraft. At the Royal Aircraft Establishment, while still in his twenties, he studied the then new science of aerofoils and formulated new theories of compressor and turbine design. In 1926, on the basis of these theories, he proposed a gas turbine engine which he claimed would be lighter, smaller and more efficient than piston engines for aircraft.

Dr A. A. Griffith

"Dr Griffith's proposal—unlike that of Sir Frank Whittle, whose work on jet propulsion began in 1928—was based on the axial type of compressor. Both men were right; Whittle's simpler centrifugal compressor enabled quicker development of the jet engine in the short run, but Griffith's belief in the superior efficiency of the axial type is vindicated by its subsequent adoption throughout the world.

"Dr Griffith's best-known proposals have stemmed from his belief in the possibilities of the axial engine. He led the company's first investigations of gas turbines—then known as 'internal combustion turbines'—during the early years of the Second World War. It was a technical memorandum prepared by him in 1945 which was the basis of the Avon engine, the first Rolls-Royce jet with an axial compressor. . . .

"In 1941—before the first British jet aircraft had even flown—he had foretold the development of vertical take-off based on the high power-to-weight ratios which he knew were possible with the axial engine. The Flying Bedstead and the Short SC.1 are successive stages in the development of his idea. The company's present unique experience of lightweight engines for jet lift, in which an increasing interest is being shown all over the world, owes much to Dr Griffith's initiative. The supersonic jet-lift airliner which he first proposed nearly ten years ago now seems far less incredible than it did to many then. . . .

"Dr Griffith has always avoided any sort of public recognition of his work. He is of a naturally retiring disposition, although with those who know him well he has a dry sense of humour which finds the weak point in an argument with unerring accuracy. He talks about his work very little. There are very few people able to keep up with his reasoning, and nearly all his work has been secret, precluding public discussion. This is why he gave no lectures or papers. By the time a subject could be aired publicly it was—by his standards—out of date and of little further interest. Despite his avoidance of publicity, his work was recognized by Fellowship of the Royal Society in 1941, by a CBE in 1948, and by the award of the Silver Medal of the Royal Aeronautical Society in 1955."

U-2 Trial Evidence

AS recorded on page 286, the American U-2 pilot Francis Powers was sentenced in Moscow on August 19 to ten years' imprisonment. Below are given various points of technical interest which emerged during his trial.

In his answers to the Public Prosecutor, Powers said he set out from Peshawar at about 0630hr on May 1. He flew at his maximum height, which was about 68,000ft. Before he was shot down near Sverdlovsk, he had flown about 1,200 miles above Soviet territory for three or three-and-a-half hours. "I was told it was absolutely safe and at such an altitude I would not be shot down." His machine carried equipment in the tail which distorted radar signals. It had a downward-pointing periscope which enabled the pilot to see aircraft beneath him.

Describing the route, Powers said that one of the points over which he had to fly was east of the Aral Sea; another, north-west of Chelyabinsk; others, before and after the city of Kirov. He was to land at Bodø in Norway.

Powers said that after training in the US he had been sent to Detachment 10-10 at Adana. Its task was primarily to collect information along the borders of the Soviet Union, and also to carry out weather research and take samples of air radioactivity. The detachment was under military command but most of its personnel were civilians. He said he could not say whether NASA (National Aeronautics and Space Administration) had any relation to "10-10."

His flight on May 1 had been undertaken in accordance with a contract he had signed with the US Central Intelligence Agency. He gave his altitude when the aircraft was hit as 68,000ft, though he said he had no idea what had shot him down. A report from the rocket commander near Sverdlovsk was read, stating that a rocket had been launched and had destroyed its target. Powers said he attempted to eject, but the ejection seat failed. At 30,000ft he released the canopy; g forces threw him half out of the aircraft, but he had forgotten to disconnect his oxygen equipment. He got out at 14,000ft, his parachute opening automatically.

Points from evidence by Soviet experts revealed that (a) there were no identification markings on the aircraft; (b) from an examination of negatives, it was estimated that photographs had been taken from a height of between 65,600ft and 68,900ft and covered an area from the north of the Soviet border with Afghanistan to the vicinity of Sverdlovsk; (c) aerials on the aircraft were capable of picking up four different wavebands and the receivers could pick up various sorts of radar signals, an analysis of signals registered by a tape recorder in the U-2 showing that they belonged to Soviet anti-aircraft radar stations, long-range spotting and fighter direction radars; and (d) the U-2 contained enough explosive—about 3lb of hexogen—to destroy the aircraft and its equipment. A photographic expert said the U-2 had a special wide-angle camera of the 73-B type. It could photograph a strip of territory about 100-125 miles wide.

Other specialist witnesses referred to documents which included (a) parts of the map on which were marked the route from Peshawar to Norway, and points over the Soviet Union where Powers was to switch on his reconnaissance equipment (the flight was to be made at an average speed of 470 m.p.h.); and (b) Powers' logbook, with entries made during the flight, a chart with a weather forecast, and reserve charts in case of deviation from the route or a forced landing.

"FLIGHT" AND THE FARNBOROUGH SHOW

Next Friday onwards—three special numbers. Demand for these Show issues is always heavy, so advanced orders to newsagents are advised. The greatly enlarged September 2 issue will sell at 2s 6d, the other two at the normal price of 1s 6d.

September 2: "Britain's Aircraft Industry." A detailed, specially illustrated review of British aircraft, missiles, engines and components, including a quick-reference directory to the products of several hundred firms.

September 9: "Farnborough Report." A first-hand report on the aircraft and flying demonstrations at the opening of the Show.

September 16: "Farnborough Review." The rest of the Show-week news and pictures, with a detailed survey of technical progress. Regular features will appear in this and the other two issues.

Missiles and Spaceflight

Prof Sir Harrie Massey presenting the inaugural lecture at the opening ceremony of the International Astronautical Congress

SPACEFLIGHT IN STOCKHOLM

FOR every participant at the eleventh International Astronautical Congress in Stockholm last week the problem was one of selection. Up to five lectures were being presented simultaneously during the first working day; there were 80 papers before the general sessions and plenty more before the four specialized meetings held in conjunction with the Congress; the fare was rich and plentiful and indigestion inevitable. After the thousands of words spoken on space during each day, it was appropriate that a practical demonstration of what the broad subject was about, in the form of the slow, steady transit of the Echo satellite 1,000 miles high, was available to those who cared to look up into the sky on most nights during the Congress.

At the official opening on Monday, August 15, the President of the Royal Swedish Academy of Science, Prof Bertil Lindblad, welcomed delegates to Sweden and reviewed the field of space research from three viewpoints; as a link between geophysics and astronomy, and providing new impetus for solving classical problems in celestial mechanics; for its practical uses; and for the engineering refinements which it was bringing. The spirit of adventure in this field, he said, was a most stimulating thing.

What the programme described as "addresses of greeting" were next presented by Mr Åke Hjertstrand of Sweden, chairman of the organizing committee; Academician Leonid I. Sedov of the Soviet Union, president of the International Astronautical Federation; and Dr Richard W. Porter, vice-president of COSPAR. Academician Sedov said that international co-operation in space research was extremely valuable and useful, and he laid particular stress on the United Nations efforts towards this end. He also suggested that the main task of the IAF Congresses was to develop international contacts with a view to encouraging space work. In fact, he concluded that some future space problems would be so expensive to solve that they would demand international co-operation.

The opening ceremony was concluded with the inaugural lecture, *Science Research Using Space Vehicles*, by Prof Sir Harrie Massey, Quain Professor of Physics at University College, London, and chairman of the Royal Society's National Committee on Space Research. After explaining that in certain respects he was there under false pretences, not having contributed directly to space exploration but only having taken advantage of other countries' developments to carry out scientific research which would otherwise be impossible, Sir Harrie went on to give a comprehensive survey of his subject. The broad fields discussed in turn were the Earth's atmosphere and how it merged into space; the Sun; the region between the Earth and the Sun; the physics and chemistry of the Moon and the planets; astronomy generally; study of cosmic radiation; study of the force of gravity; and the "most exciting possibilities" in the field of basic biology.

At a press conference that evening details were announced of the International Academy of Astronautics of the IAF, a body proposed at the London congress one year ago and whose statutes had now been formally approved. Director of the Academy is Dr Theodor von Kármán, who gave the credit for the actual spadework in founding the academy to Dr F. J. Malina, an American scientist working in France.

A slight gap in the international-co-operation front was disclosed with the news that the Soviet scientists who had been invited to become members of the academy had declined to accept. The reason given was that, although they were in sympathy with the motives behind the setting-up of the academy, they thought perhaps there were too many similar organizations already in existence.

The academy has elected its members in three main categories, concerned respectively with the basic sciences, engineering sciences and life sciences (which includes legal as well as medical science). The first list of academicians includes the names of four British scientists; Prof A. C. B. Lovell and Dr J. G. Davies of the Nuffield Radio Astronomy Laboratory, Jodrell Bank, in the first category, and Mr A. V. Cleaver of Rolls-Royce and Dr L. R. Shepherd of the Atomic Energy Establishment, Winfrith (and chairman of the British Interplanetary Society) in the second. It transpired that Prof Massey was in agreement with the Soviet scientists, for he, too, had declined to accept the honour of membership. There were already too many organizations and too many meetings to attend, he said firmly.

With the financial help of the Guggenheim Foundation and assistance in obtaining accommodation from the French Government, the Academy will formally be in business on September 1. The first and most intriguing project it will tackle will be a feasibility study of an international lunar laboratory, re-shuffled as "lunar international laboratory" to provide a more acceptable contraction of initials.

Social interlude: L. to r., Dr Wernher von Braun (USA), Mrs von Braun, Academician Leonid Sedov (USSR)

The committee formed to look after LIL has as chairman Dr F. J. Malina (USA) with Prof Lovell of Jodrell Bank as vice-chairman. A promising sign amid the delicate international moves and countermoves is that Prof Sedov is a committee member. To be a committeeman without being an academician is apparently both legal and ideologically acceptable.

At nine o'clock the next day, August 16, the marathon began with the review lecture on the US rocket programme by Dr von Braun (pages 291-2). Specific United States projects were described in *Pioneer 5 and Explorer 6, Systems Engineered Space Probes* by George E. Mueller of Space Technology Laboratories, and *US Air Force Discoverer Program*, by Col H. L. Evans of the USAF Ballistic Missile Division.

Soviet papers presented on the same day comprised *On the Reverse Side of the Moon* by Prof A. A. Mikhailov; *The Exploration of Outer Space* by S. N. Vernov; *Some Problem of Physics of the Upper Atmosphere* by Prof V. T. Krassovsky; *Studies of the Magnetic Field of the Earth and the Moon* by S. S. Dolginov, E. G. Eroshenko, Z. N. Zhuzgov, N. V. Pushkov and L. O. Tyurmina; and *Results of Exploring Meteoric Matter with Instrumentation of Sputnik 3 and Space Probes* by T. N. Nazarova.

Prof Mikhailov described the fascinating piece of detective work involved in deciphering the photographs of the far side of the Moon taken by Lunik 3, and in building-up a complete Moon

Missiles and Spaceflight . . .

atlas. The chart of the Moon which he displayed contained 498 separate features, of which 251 were so well defined that there was no doubt of their existence (including about 100 situated in the visible part of the Moon), 190 were less-conspicuous features; and 57 were of hazy origin and could not be guaranteed as genuine. The map was compiled from only nine separate photographs, four taken with Lunik 3's short-focus camera and five with the long-focus camera, but almost 100 prints were used.

Meanwhile, in other lecture halls, legal, medical and sounding-rocket specialists were discussing their own particular fields. At the third Colloquium on the Law of Outer Space a masterly review paper on *International Control of Outer Space* was read by Mr C. Wilfred Jenks, a British lawyer who is chairman of the Commission on Space Law of the Institute of International Law. The second major topic at this meeting was that of damage to third parties on the surface caused by space vehicles.

Before the Space Medical Symposium *Man-Machine Systems in Space Vehicles* was the first discussion subject. Under this heading the papers included two by doctors from the RAF Institute of Aviation Medicine at Farnborough; *Human Frequency-response to Vibration* by Flt Lt J. C. Guignard, and *Control of Microclimate Temperature in Very Hot Environments* by Flt Lt J. Billingham.

Among the papers presented on Wednesday, August 17 were several in the field of propulsion. Two of these were of a review nature, *Present and Future Propulsion Systems—a Survey*, by S. K. Hoffman of Rocketdyne; and *Progress in Electric Propulsion Systems for Space Vehicles*, by Dr Ernst Stuhlinger of NASA.

Dr Stuhlinger emphasized that, for near-Earth missions or fast trips to the Moon, chemical rockets would remain superior to electrical systems. Journeys to Mars and Venus would take about the same time by either method, although electric propulsion would give an improved payload. Continuing farther out in the solar system, the electrical rocket engines would be particularly impressive in comparative performance. A chemically powered probe to Pluto, for instance, would take 45 years to get there, and "most of us could not wait that long." Using an electrical system the trip would take only three years.

The speaker listed nine types of electrical propulsion systems using separate power sources: these were nuclear-heated, resistance-heated, arc-heated or electrothermal, solar-heated, electrostatic (ion propulsion), electrodynamic or magneto-fluid-mechanic, solar sail, partial photon and ideal photon. Of these he described three in detail: the electrothermal, electrostatic and electrodynamic systems. Arc-heated and ion systems, Dr Stuhlinger suggested, should be flying on small test satellites by 1962; and by 1964-65 we hoped to have the first small, modest space vehicles driven by electrical systems.

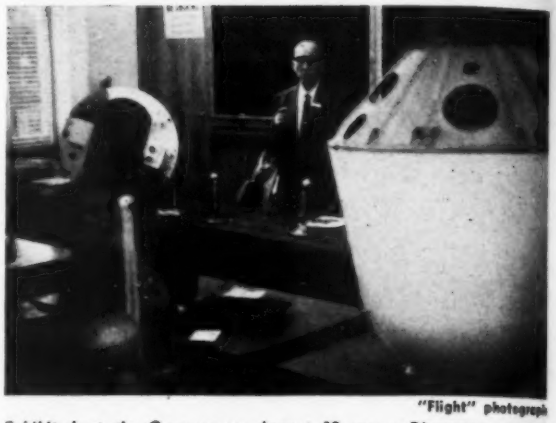
Among the specific projects discussed in other papers was a 30kW electrothermal rocket engine, developed by the Avco Corporation under USAF contract, which had produced 0.75lb of thrust at a specific impulse of 1,000sec during a 47hr test run using helium as the working fluid. This was described in *A Working Arc Jet Rocket Engine*, by R. R. John, J. F. Connors and A. Mironer. Such an engine, in which the thrust is derived from gas which is heated by passing through an electric arc and then expands supersonically through a rocket nozzle, could be used to transfer a communications satellite from a 300-mile orbit to one at 22,500 miles, the initial launch to 300 miles having been made by a chemical rocket.

The main-session papers on space medicine, as distinct from the special symposium on the subject, began with *Survey of Space Medicine and Astrobiology*, by Dr Hubertus Strughold, professor of space medicine and adviser for research at the USAF Aerospace Medical Center at Brooks Air Force Base, Texas. Dr Strughold said that manned flights in medium orbits around the Earth, between 800 and 80,000km, were too hazardous because of the danger of radiation from the Van Allen belts. Only low orbits, between 200 and 800km, were practical for manned flight, while high orbits, above the radiation belts, were probably neither practical nor useful.

For the next stage, that of manned lunar and interplanetary journeys, Dr Strughold suggested, minimum-time trajectories as opposed to minimum-energy trajectories should be regarded as a medical prescription.

On Thursday, August 18, the congress exhibition and films were open to the general public, but no official papers were presented. Participants reassembled on Friday, August 19 to hear a further varied selection of papers, plus the biggest news of the week—the first reports of the launching of the Soviet "spaceship" satellite carrying two dogs, other animals and biological specimens. A duplicate Discoverer capsule was exhibited and described by representatives of the USAF and the General Electric Company (see Sputnik 5 and Discoverer 14 news items on page 286).

Friday's papers included *The Practical Applications of Space Nuclear Power in the 1960s*, by J. R. Wetch and H. M. Dieckamp of Atomics International (a Division of North American Aviation) and Lt-Col G. M. Anderson of the US Atomic Energy Commission; *Sea Launch of Large Solid-propellant Rocket Vehicles*, by J. E. Drain and C. E. Stalzer of the US Naval Missile Center, Point Mugu; *The Meteorological Satellite*, by R. P. Haviland of the Missile and Space Vehicle Department of the General Electric Company; *The Post-launch Performance of the Tiros 1 Satellite*, by Sidney Sternberg of Radio Corporation of America; *Space Transport by In-transit Rendezvous Techniques*, by C. E. Kaempen of North American Aviation; and *Communications Satellite Orbits*, by W. F. Hilton and S. R. Dauncey of the Advanced Projects Group of Hawker Siddeley Aviation.



"Flight" photograph

Exhibited at the Congress on August 19 was a Discoverer re-entry capsule (right) and recovery package (left), identical with those successfully recovered on August 11 and 20. Answering Press questions is R. P. Haviland of the General Electric Co, makers of the capsule

In the first of these, Wetch and Dieckamp describe the major operational, installation and handling characteristics of the SNAP 10, SNAP 2 and SNAP 8 nuclear power units now under development for the US Air Force and for the NASA. In the *Sea Launch* paper, a proposed system for the vertical flotation and firing of solid-propellant boosters on the surface of the ocean is presented. Advantages claimed are that handling and logistics requirements are simple, mobility is unlimited over ocean surfaces, and "the launch pads are free, water-cooled, and self-healing."

The potential usefulness of an artificial satellite in the field of meteorology was examined by Mr Haviland. In his *Tiros* paper Mr Sternberg took this subject one stage further by describing the results obtained from the first weather satellite to be successfully launched. The passive thermal design, camera coverage and camera resolution had proved "quite successful"; the power supply was "more than ample," and radio communications had been reliable.

Tiros 1 had proved extremely valuable as a meteorological research tool. Large-area weather systems had been photographed and identified. Known and apparently new phenomena of clouds and weather had been observed.

The in-transit rendezvous techniques advocated by Mr Kaempen were designed to overcome a "limited propulsive thrust capability" in the transport of men and materials to lunar and interplanetary regions. These techniques involved two or more individually launched space vehicles which would rendezvous en route for assembly into a single unit.

The authors of *Communications Satellite Orbits*, the only British paper to be presented in the general sessions, suggested that eccentric elliptical orbits (apogee height 8,000-25,000 miles, perigee height "a few hundred" miles) would give communications coverage superior in several ways to that of circular orbits, including the 24hr "stationary" orbit. A network of such elliptical orbits, either near-equatorial or at 63° inclination, could give the required worldwide coverage.

On Saturday, August 20, final day of the congress, the papers included *A Conceptual Design for a Manned Mars Vehicle*, by P. Bono (USA); *Heliodyne: a Solar-powered Interplanetary Vehicle*, by E. T. Benedikt, R. W. Halliburton and C. C. Kelber of Northrop Corporation; and *Space Ecological Systems 1960-75*, by E. B. Konecci of Douglas Aircraft Company.

At the end of the meeting it was announced that Prof Sedov was to continue as president of the International Astronautical Federation for a second year. Vice-presidents are Dr H. S. Seifert, USA; Dr L. R. Shepherd, UK; Prof R. Pesek, Czechoslovakia; Prof I. Péres, France; and Obering F. Staats, W. Germany. The next IAF Congress will take place in New York in 1961 and will be organized by the American Rocket Society.

Missiles and Spaceflight...

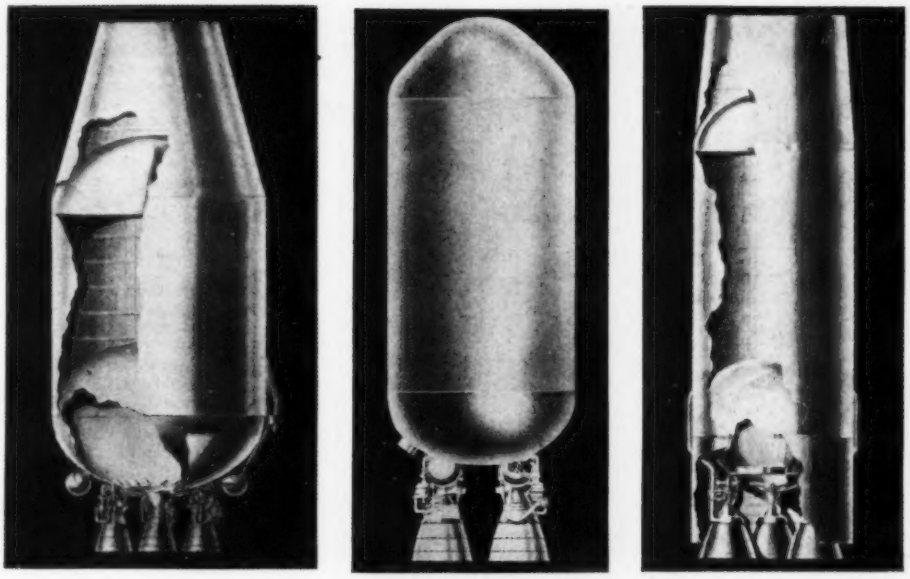


Fig 1. The first illustrations of Saturn upper stages (not to common scale). Left, C-1 second stage (four 17,500lb Pratt and Whitney LR115 hydrogen/oxygen engines), 220in diam, by Douglas. Centre, the C-1 third stage (two LR115 engines), 120in diam, by Convair (modified Centaur). Right, the C-2 second stage (four of the new Rocketdyne 200,000lb hydrogen/oxygen engines), 220in diam, contractor not yet named

SATURN'S ROLE IN SPACE

ALTHOUGH presented under the title *United States Space Carrier Vehicle Program*, the paper delivered by Dr Wernher von Braun, Director of the George C. Marshall Space Flight Center, Huntsville, before the International Astronautical Congress in Stockholm on August 16 was primarily concerned with one booster only—the mighty Saturn, first large space launcher not derived from a ballistic missile.

Dr von Braun's paper began with a review of American space rockets to date, grouped in "generations." First generation vehicles comprised Juno 1 (Jupiter C) and Vanguard; the second generation was the family of Juno 2, Thor Able/Delta series, Thor Atlas-based vehicles: Score, Atlas Mercury, Atlas Able and Atlas Agena A. The third generation, now under advanced development by the National Aeronautics and Space Administration, was tailored to specific types of mission: Scout, for vertical space probes and small satellites; Thor Agena B, for medium Earth Agena A and Thor Epsilon. Next came an interim phase of satellites; and Atlas Agena B and Atlas Centaur for large Earth satellites, hard and soft lunar landings and interplanetary probes.

All the fourth-generation carriers would be based on the Saturn, now under development at Huntsville. Much of the information on Saturn and the background to its development given in Dr von Braun's paper was covered in the special article on it in *Flight* of August 5, but the illustrations on these pages and the details of Saturn missions which follow were given for the first time in the Stockholm lecture.

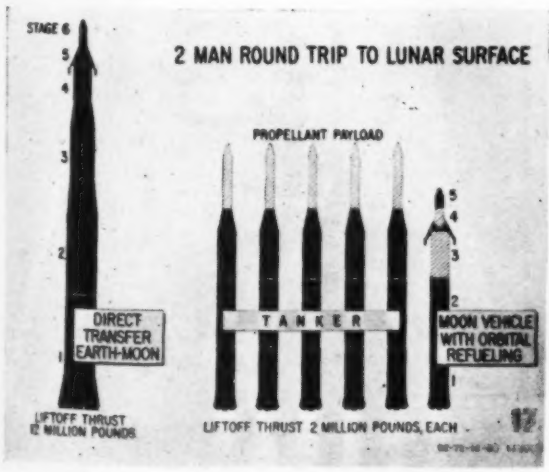


Fig 2. Vehicles for a two-man round trip to the lunar surface; left, direct transfer; right, orbital fuelling

The Saturn programme, Dr von Braun said, had evolved into a long-range development plan that, through continuous development of building-block upper stages, would provide not only a substantial early payload capability but a final configuration that would exploit the maximum capability of the Saturn first stage.

What were these capabilities? The C-1 version would be able to lift 20,000lb into a low Earth orbit. For more-demanding missions it should be capable of boosting a 6,000lb payload along an escape departure trajectory and of landing 1,000-2,000lb softly on the Moon. As for the hypothetical C-2 vehicle (Fig 1), a three-stage version could be used to place some 45,000lb into a low orbit, while the payloads for high-speed missions would be more than twice those of the C-1.

These escape missions were based on direct flights from the Earth into departure trajectories. If an orbital refuelling operation were considered for the Saturn single-flight performance, the capability for such missions as a manned lunar soft landing or a planetary landing could be increased by a factor of ten or more, depending on the number of Earth-to-orbit refuelling flights and the mission requirements. A direct-departure vehicle could of course enter at first a low-altitude waiting orbit and then transfer to an optimum departure trajectory.

The quicker and less-complex direct transfer of a two-man spaceship to the Moon's surface, with safe return for the crew, would require a lift-off thrust of about 12m pounds (Fig 2). With a present basic Saturn thrust of less than 2m pounds, therefore, the direct transfer would simply not be possible until a much larger, fifth-generation carrier became available. For the early accomplishment of manned lunar-surface missions, it followed that orbital refuelling techniques must be considered.

To accomplish refuelling, a reliable orbital rendezvous technique was necessary. The carrier would first lift the lunar spaceship into an Earth orbit and, after refuelling, would depart for the Moon. Orbiting working crews, trained to perform certain functions under zero-gravity conditions, were needed to connect the spacecraft and tanker and transfer the propellants.

The limited time period for the whole operation might demand a substantial number of Saturn launch pads on Earth. Apart from the all-important human needs, limitations on time caused by the orbital storage of hydrogen over extended periods between individual tanker flights might be a serious factor; if this proved decisive, lower-energy storable propellants might have to be used for the craft, thereby increasing the number of tanker flights by 50 per cent.

In spite of a number of disadvantages, the orbital refuelling technique did seem to offer some definite advantages over and above the primary consideration of its earlier availability. The orbital system was very flexible—many different types of vehicle for a variety of missions could be assembled in orbit. A large vehicle could be assembled from a number of smaller ones and, even if the required thrust for direct transfer were available in a given year, the smaller, orbital-refuelled vehicles would be of a

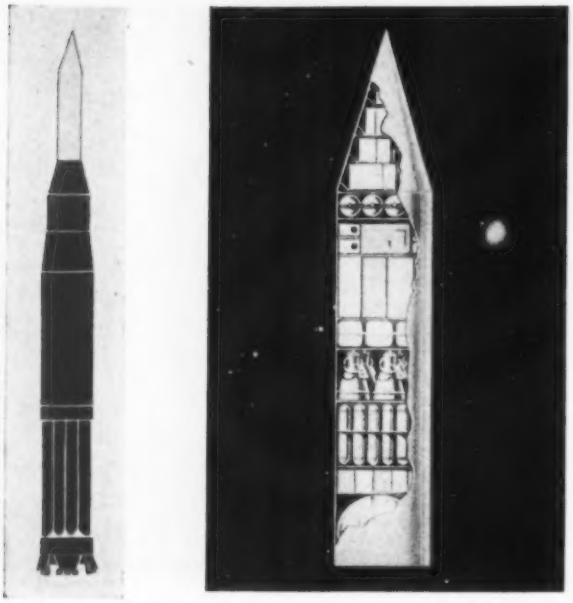


Fig 3. Dr Von Braun's proposal for a Saturn-boosted cargo vehicle

Missiles and Spaceflight . . .

more mature vintage and therefore more reliable. Furthermore, a space station would be an ideal ready base with which high-acceleration space carrier vehicles could rendezvous, and the transfer could be made to low-acceleration (ion or plasma) orbit-to-orbit spaceships.

For the next ten years or so, the lecturer summarised, these conclusions should be valid:

(a) The orbital refuelling method might permit missions to be realized sooner;

(b) The direct-transfer method might be cheaper, but almost certainly would come later; and

(c) The orbital-transfer vehicles would be more reliable, but the direct transfer would be a less complex operation.

The present development of orbital techniques was more-or-less a by-product of the concentrated efforts being devoted to instrumented artificial satellites and the early man-in-space capsules. It was quite apparent that the development of manned satellites and manned space stations would follow as a logical development sequence to these efforts.

An interim concept, which seemed feasible and which could benefit from state-of-the-art progress made in the Mercury programme, would incorporate the technique of orbital refuelling and other orbital operations in a plan to use the Saturn vehicle for establishing and maintaining a minimum manned space station. Three typical stage configurations were envisaged for the transport of men, propellants, equipment and supplies via the Saturn into an Earth orbit. All would have the same dimensions, and would be top stages of a series of Saturn C-2 carriers.

The manned top stage, once stabilized in orbit, would become a permanent space station; second and third versions would be unmanned and would be designed to supply propellants or (Fig 3) cargo to the space station. All these vehicles would be pre-assembled on Earth and fitted on to the top of the C-2 carrier vehicle.

The manned station would have three individually sealed compartments: the crew capsule for powered flight, emergencies, and re-entry; the instrumentation and working area; and the supply storage room. Once in orbit, the members of the crew would move from one compartment to another by crawling through a fixed or inflatable tube on the outside of the station.

In addition to contoured beds, the re-entry capsule would contain environmental control equipment, electrical power equipment, oxygen, food, water, and other supplies adequate for the station's planned operating period, with sufficient reserves for the return trip to Earth and for possible emergencies. Mounted in an inverted position on top of the other stages, the heavily insulated lower wall of the capsule would offer maximum protection for the crew during launch, ignition and burning of all stages of the carrier vehicle, and during re-entry (Fig 5).

Parachutes for recovery and possible emergency use during launch would also be located inside the capsule, while solid rockets used both for pad escape and re-entry deceleration were housed forward. If escape at the time of launch should be necessary, six rocket motors providing an acceleration of 12g would lift the capsule to about 4,000ft. For re-entry, these rockets could be ignited sequentially in pairs to provide the required impulse for deceleration and the re-entry manoeuvre.

The instrumentation compartment would house the equipment needed to carry out space observations and experiments; all other supplies and standby equipment would be located in the storage compartment. Bulkhead space would contain additional equipment for the particular mission.

The possible future Saturn C-2 would not only be capable of placing small manned space stations, cargo ships and propellant tankers into orbit, but could also place a shorter version of the space station into a circumlunar trajectory. Such a manned circumlunar spaceship (Fig 4) would have the same escape capsule as the orbital space station, and preliminary estimates indicated that it would weigh about 15,000lb, including 6,000lb for the capsule with its instruments and controls. This capsule might well be fitted with lifting devices for use during re-entry prior to the time the parachutes were deployed.

In addition to the 6,000lb re-entry capsule, 4,000lb would be devoted to what the speaker called the caboose—the section where the scientific payload, cargo, etc., would be carried. Finally, some 5,000lb would have to be allotted to a combination abort and mid-course control (and possibly re-entry deceleration) propulsion system. If this propulsion system were not required for an emergency abort prior to the injection of the spaceship into a lunar trajectory, the propellants would be used for course adjustments.

Fig 4 (left). The circumlunar capsule, designed as a Saturn upper stage, for taking two men round the Moon and back to Earth

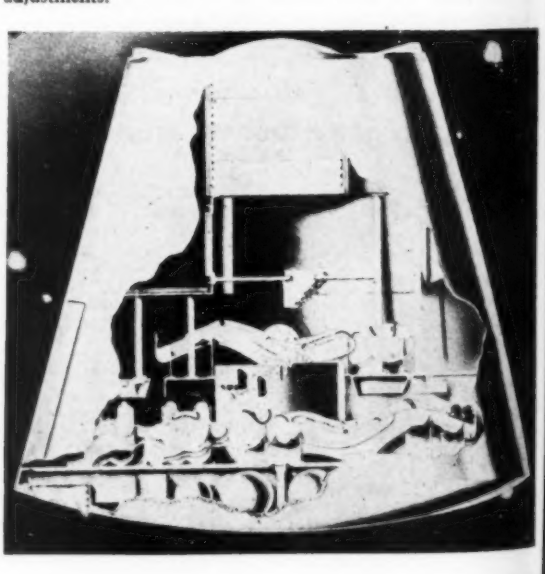


Fig 5 (right). The upper portion of the circumlunar capsule serves as a re-entry vehicle protected against the Earth's atmosphere

HAD I BUT WINGS . . .

By Mike Reilly

A Competitor's Exclusive Story of the Fifth World Parachuting Championships

Vodenicherev, Bulgaria, driving for the cross with maximum effort

MOUSATCHEVO. The name has a romantic sound. One can imagine this as the setting of a medieval court, or, alternatively, as the scene of some lurid cloak-and-dagger enterprise. Perhaps for that reason, it does not seem strange to be sitting in an old Antonov An-2 biplane and drawing lots to determine who shall be first to open the door and hurl himself earthwards for 6,600ft through the clear Bulgarian sky.

The explanation is that this pretty aerodrome (20k from Sofia) is the venue for the Fifth World Parachuting Championships, and my five companions and I are drawing lots for order of jumping in event No 3. This consists of a delayed opening (free fall) descent, during which aerobatic manœuvres must be performed in response to a signal from the ground. All figures must be completed by the 20th second of free fall, and the parachute must then be opened between the 23rd and 30th second, at approximately 2,300ft.

Six parachutists, from different countries, fly in each aircraft and my five companions include a Canadian, a Rumanian, and three very pretty girls respectively from Poland, Czechoslovakia, and Russia. All wear identical white flying suits and helmets, so that the judges will have no knowledge of their identity.

Our order of jumping is soon established as Rumania, Russia, Poland, Canada, Czechoslovakia and Great Britain; and the aircraft then banks for the first of six circuits. The door is opened by Valentine Turconu of Rumania, and the fuselage is flooded with an inrush of air and sunshine. The engine is throttled back in response to a signal from the man at the door, and the next instant Valentine's spread-eagled figure is silhouetted against a background of sky and distant earth. (Most parachutists adopt a swallow-dive position during free fall, with the legs widely parted. This ensures that the body is stabilized on the uprush of displaced air, and turns can be performed merely by altering the position of arms and legs.

Three more circuits follow, and then I am standing in the doorway behind Elena Mjartanova of Czechoslovakia, in a position where I can observe her performance without impeding her exit from the aircraft. Her small gauntleted hand signals for the engine to be cut as the dropping panel appears underneath; and then, with a last shy grin, she starts her stopwatch and pivots around the door. As she streaks earthwards, a white panel (shaped like an F with the top stroke missing) materializes on the ground for five seconds, and her dwindling figure sweeps into the appropriate manœuvres (five turns of 360° in the sequence right, left, right, left, left, followed by a loop). She flies in the Russian position, with arms and knees bent, and turns mainly by tilting the hands and arching the body to the desired side. Her loop is completed by the 18th second, so she will have scored ten bonus points if the judges are satisfied with her performance of the figures.

Suddenly the aeroplane seems a lonely place, with only the judge and pilot for company, and it is a relief when the pilot turns into wind and the dropping bar once more appears underneath. The engine roar dies, and the machine seems to hang near the stall, as I click the stopwatch mounted alongside the altimeter on top of my reserve (chest) 'chute, and hurl myself around the door to face into the slipstream. My body tilts into a comfortable horizontal stable position, and suddenly the signal on the ground has winked in the shape of a cross (right, left, right, right, left—loop!). By arching my body to the right, and moving both bent arms in that direction, I flick round in the first turn.

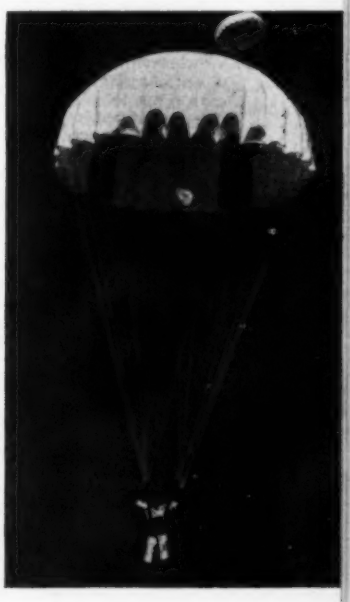
The directional arrow on the ground once more appears before me, and I bank in the opposite direction. It is very important that all turns should start and end in exact alignment with this arrow, as any deviation may entail loss of points, or even disqualification if the error is greater than 45°. The world becomes a whirling kaleidoscope of earth, horizon, and—most important—signal arrow. The fifth turn is rather fast, and a forceful wrench of the body is needed to prevent overshooting. Now for the loop—arms forward and knees up to the chest! As the body flicks into a fast back somersault, and the sky appears, one moves the arms back to a "delta" position in order to maintain momentum on the correct heading. When the earth first appears in view again, you spread your legs widely to prevent rolling laterally.

Now there is time to consult the stopwatch and, as the hand creeps towards the red line drawn at 26 seconds, to prepare for a good flat opening. The hips are forced earthwards, the chest lifted; the right arm is brought smoothly to grasp the ripcord handle and is then rapidly thrust back to its normal outflung position. With the body still in a perfectly stable position, so that there is no risk of damage to the deploying parachute, one can listen to the hiss of escaping nylon before being lightly jolted to a halt.

No points are allotted for precision landings in this event, so I can laze my way down the sky and reflect on the series of events that have led to this particular jump.

* * *

The World Championships are held every second year, and teams normally consist of four men and three women. Britain was represented this year by Tony Charlton (Sky Divers Club and RAF), Denis Lee (Sky Divers Club), Alf Card (Oxford Parachute Club and RAF) and Mike Reilly (Ripcord Club). The last-named was team captain, and Flt Lt Peter Hearn was a very capable



(Left) Golobov and team-mate Doinski demonstrate the Bulgarian triple gore. (Right) Anikiev and Soviet comrade during the team jumping event

HAD I BUT WINGS . . .

reserve and administrator. Unfortunately, we had no practising women parachutists of the necessary standard.

As usual the team had been organized on a private-enterprise basis, and the members had provided their own equipment and most of their fare money. This contrasts rather oddly with the State-subsidized contingents from most other nations. The following fifteen countries were represented: Rumania, Hungary, USA, Austria, USSR, Canada, Czechoslovakia, France, Poland, Bulgaria, Yugoslavia, Britain, Switzerland, Germany, and China.

The tournament consisted of the following three events, in all of which the competitors were required to jump from 6,600ft (2,000m) and delay opening their parachutes for between 23 and 30 sec:—

(1) **Individual precision landings.** The target is a cross 9m in radius, enclosed in a circle of 100m radius. Two hundred points are scored for landing on the centre of the cross and this figure is progressively reduced for every centimetre and metre away from the centre. Four jumps are made, and the best three scores are recordod.

(2) **Team precision landing jumps.** All four team-members jump in a rapid "stick," aiming for the same target as in event No 1 and their average landing distance is recorded. Four jumps are made, and the worst collective effort is discarded.

(3) **Style jump with aerobatic figures ("Sky Diving").** Two jumps only are made in this event, and each competitor must perform five turns of 360° (whilst maintaining a prone horizontal position) followed by a loop. The sequence in which these turns are made is dictated by a signal panel which is switched on as soon as the jumper leaves the aircraft, and is extinguished five seconds later. Bonus points can be scored for completing the sequence in less than 20sec and penalty points are deducted if this time is exceeded.

For the first time, the team championship was being determined solely on the result of the team ("stick") jumps. Individual champions would emerge from the other two events, and, in addition, there would be an overall individual champion based on the highest combined score in Events 3 and 1.

The two practice jumps, which were made by all entrants before the opening of the contests, gave some indication of the improved standard attained by all teams since the last championships in 1958. Landings were made regularly within less than 3m and anyone who landed outside the 9m circle of sand enclosing the cross was considered to have made a mediocre jump.

New Canopy Designs

Several revolutionary designs of steerable parachute were on show, and it was significant that most teams used a low-porosity fabric which provided an extremely slow rate of descent, and could be steered across the sky at twice the speed of our British equipment. Almost every country favoured some version of the "blank gore" parachute canopy, but few older British jumpers would credit the astounding manœuvrability of these foreign improvements on what was, originally, a British invention.

The "blank gore" canopy has one complete segment (a gore) removed, and through this hole the uprush of air, caused by the descending body, is deflected as a "jet" that propels one across the ground. This gore is usually positioned behind the jumper, and, by pulling on one or other of two control lines, he can rotate the canopy so that he faces in any desired direction. The conventional British "B.G." has a forward speed of approximately 4½ m.p.h. in still air, but Tony Charlton, Denis Lee and the writer had modified canopies with two separate blank gores, which provided a speed of 7½ m.p.h. When one considers that competitions take place in winds of up to 18 m.p.h., this is obviously inadequate, and accuracy will often be dependent upon jumping far enough up-wind to ensure that one drifts correctly to the target—the slightest arithmetical miscalculation, in these conditions, can mean failure.

Most other countries have such a low porosity-rate in their parachute material that the air which is prevented from escaping through the weave is deflected through the open gore in a far stronger "jet," and speeds of 11-12 m.p.h. are achieved. In addition, the slower rate of desecent permits more time for manœuvring. The most impressive designs are the Bulgarian "triple gore," which has two further small panels cut away on either side of the main gore; the Russian double "angled" gore; and the French triangular gore, set in a dome-shaped canopy. Of the high-porosity canopies, the American "Conquistador" (or TU) parachute is the fastest and most steerable, but the greater number of cut-out panels give it an extremely fast rate of descent (22ft/sec).

Following the official opening ceremony a very impressive air display was presented by the Central Aero Club. The wind was far too strong to permit the start of the actual championships, in which the maximum permissible speeds are 6m/sec for women and 8m/sec for men; but the Bulgarians dropped 150 parachutists using static-line-operated square parachutes. Landings were made

Pierre Arrussus, France, roars in with the triangular-gore canopy developed by the French team

(Right) The writer of this article using the British home-made double-gore parachute

at express-train speed, and six of these intrepid aviators were injured—one seriously. The "drifters" for this mass descent were six gallant young men who left the cockpits of light aircraft in the middle of slow rolls or bunts!

Weather would clearly be the predominant factor in this tournament. The nearby Balkan mountains seem to produce violent winds, and almost every second day witnesses strong gusty conditions. In these circumstances accurate landings are often unpredictable, but are nonetheless a fair indication of skill.

In order to entertain the large crowd which gathered on Monday, August 8, the organizers started the programme with Event No 2 (team jumps). It is a most impressive sight to see four white-clad figures streaking earthwards before opening their 'chutes, and then juggling for position above the target. The Rumanians drew first position and were unfortunate enough to miss the circle and land in the crowd, due to running-in on the wrong alignment. Most teams were jumping in very close formation, and their accuracy was helped by sending one man down in a spiral and letting the remaining three study the effect of the wind upon his descent.

The British jumpers, regrettably, varied greatly in their accuracy and scores ranged from 5m to 96m, with the result that our three best averages became 30m, 49m and 60m. The young Canadian team, using mainly the American TU shaped-gore, performed extremely well and achieved averages of 13m, 15m and 16m. These scores contrasted with 4m by the Russians, 5m by the Czechs, and 4½m by the Bulgarians.

The American team were below their usual form, and seemed to be having trouble with last-second turns above the target. Their parachute rotates so rapidly that the jumper is swung outwards by the centrifugal force, and any last-minute manœuvre which is performed too violently can lose valuable metres if the parachutist happens to land at the wrong end of the swing. Many teams experienced this difficulty, and the most stable turns seemed to be produced by the Bulgarians, whose canopies rotated flatly above the desired spot.

Surprisingly, the Hungarians were using a plain canopy (with no blank gores), but this had a large skirting fringe around the bottom edge and a larger-than-usual apex hole to permit air to escape and so prevent oscillation. They were amazingly accurate with this equipment and achieved averages of 24m, 8m and 8½m.

The final results of Event No 2 were as follows (points out of a possible 600):—

(1) USSR, 542; (2) Czechoslovakia, 539; (3) Bulgaria, 535; (4) USA, 523; (5) France, 516; (6) Hungary, 464; (7) Canada, 447; (8) Rumania, 446; (9) Poland, 432; (10) Great Britain, 207; (11) Austria, 16.

The remaining nations were competing only in the individual events.

If any explanation is sought for Britain's low placing, the answer is simply lack of practice, the need of a good steerable parachute, and, frankly, shortage of experience. We had the best team we had ever fielded and performed better than in previous years; but all the other countries have improved since the last championships, and most of their jumpers had made an average of 130 descents this year in preparation for the tournament. In contrast the British team had an average of 30 jumps since January, and none of these had been made as a team.

However, we were improving with every jump, and could look forward with greater confidence to the results of Events 3 and 1.

* * *

By the evening of Saturday, August 13, the championships had produced the most dramatic ending to a parachuting tournament that any of the competitors could recall. The ingredients of excitement, suspense and prayerful anticipation had been such

that any novelist would hesitate to use them in a story for fear of appearing unrealistic.

Yet truth is stranger than fiction, and we had witnessed a situation in which the individual championship depended entirely upon the final jump; and there was great doubt as to whether the gale-force winds would abate sufficiently to permit this final descent. Suspense was further heightened by the fact that the leading contender (Dick Fortenberry of the USA) had dislocated his elbow and would be unable to make any last effort that might confirm his chance of the title.

All day the gale blew, and members of the various teams prayed for it to decrease or increase, according to their own scores or sympathies. If the final jump was abandoned—and the programme had to end on the Sunday—Fortenberry would be the first American to win the individual championships; but if the wind subsided sufficiently for dropping to continue on the Sunday morning it was just possible that he could be passed by Kaplan of Czechoslovakia or Anikiev of the USSR.

The final jump would be a precision landing drop, and either of the challengers would need to land closer than 1.5m in order to surpass Fortenberry's points total. He had gained a commanding lead by landing on the exact centre of the target cross—the first time that this had been achieved in a world championship—and but for his accident would almost certainly have been able to retain the lead. The questions on everyone's lips were: Would the wind drop? Could Anikiev or Kaplan produce the inspired effort needed at this stage? Was it just possible that Fortenberry might be able to jump if his dislocation (which had been reduced by a doctor) responded satisfactorily to a day's rest? It seemed almost inconceivable that the East European countries would permit the contests to end without making a final attempt to retain their customary mastery of the sport, and there were whispered suggestions that drops might be made even if the wind exceeded the permissible maximum speeds.

The emergence of the Americans as leading contenders for honours would have surprised no one who saw them perform so brilliantly at the Adriatic Cup, in Yugoslavia last year. Their all-military team were highly trained and well equipped, with good steerable parachutes. In the team jumping contest (Event 2), they were possibly a little unlucky to finish fourth, behind the Russians, Czechs and Bulgarians; but in the individual contests they demonstrated that they are the equals of any European experts.

The Soviet team—despite winning the team trophy for Event 2—were no longer the dominant performers, and top honours went equally to Czechoslovakia, Bulgaria and America. The previous world champion, Piotre Ostrovski (USSR) performed well, but never looked like repeating his success of 1958 and finally finished eighth. The standard of all competitors had improved incredibly since the last championships, and was reflected equally in the sky-diving and precision landing events.

* * *

Before coming to the crucial Saturday we must revert to Thursday, August 11. For sheer excitement, and as a test of physical and mental control, there was nothing finer than Event 3 (the sky-diving "style" jump) which was the first individual event to be contested. Speculation was rife as to whether the sequence of five 360° turns and a "loop" could be performed in less than 15sec without losing points for directional deviations, and the merits of various techniques were being widely discussed. The signal nominating the particular sequence would be either a cross

Ostrovski, USSR, the previous champion, shows how easy it is

Dick Fortenberry, USA, and his Conquistador

or a right- or left-handed "T," and competitors were to be seen practising these signals with hand gestures and frantically mumbling such incantations as "Left, right, right, left, right, loop!"

Many misread the signal or overshot the heading for their turns, and a surprisingly large number spun off the top of their "loop" (back somersault) and lost all points. It was essential that all turns should start and end in alignment with the signal on the ground, and the "loop" had to be completed on this heading. Twenty seconds were allowed for the sequence and bonus points could be earned for completing it in less time than this.

Styles varied, from the French technique of outspread straight arms and legs to the American "frog" position, in which the limbs are well bent and the back is not hollowed. Jim Arrender, of the USA, surprised many experts by completing his two sequences in 14sec and 14.5sec respectively, and won this event with a total of 449.5 points, i.e., a possible maximum of 400 plus 49.5 for speed of execution. He gains speed in his turns by arching his body sideways in the direction of turn and drawing the knee on this side forward. This has the effect of shortening his body "levers" on one side, and results in a fast flick turn. The arm and shoulder on the side opposite the turn are shrugged earthwards and, although this technique is less graceful in appearance than that used by many other teams, it is unquestionably the most efficacious for a man of Arrender's physique.

Second was Galabov of Bulgaria with 446.5 points, and third was Jehlicka of Czechoslovakia with 446. The British scores were very encouraging on this occasion, and it was heartening to find that numerous East European representatives were lower down the scale than ourselves. Our points were as follows:—

	1st jump	2nd jump	Score	Position
Tony Charlton ...	151	203	354	27th
Mike Reilly ...	168	167	335	29th
Denis Lee ...	0	153	153	40th
Alf Card ...	24	41	65	41st

Denis Lee was very unfortunate in losing all points for his first attempt. He had completed a good sequence within the time limit and prepared to pull the ripcord at the 26th second of free fall (the limits for the "delay" being 23-30sec). His hand jerked the ring but there was no movement in the attached cable, and he was forced to reach again and yank with both hands. His white-clad form streaked earthwards, and the watchers on the ground were mentally imploring him to open the reserve parachute, when his efforts were successful and the main canopy blossomed at approximately 1,000ft. This is, of course, below the minimum safety altitude set for sportsmen, and he was disqualified for that jump. An examination of his pack showed that one of the small metal cones had twisted and the ripcord pin had wedged at an angle.

We were cheered by beating our friendly rivals, the Canadians, on this exercise. They gained 39th, 34th, 42nd and 43rd places, and, as they had finished several places ahead of us in the team-jumps, we felt that honour was satisfied.

Piotre Ostrovski could only gain 15th place in sky-diving with a score of 424.5 points, whilst Dick Fortenberry (already regarded as the best American "all-rounder," and a possible individual champion) achieved sixth position, with 441 points.

After a break of one day, caused by bad weather, Event 1 (individual precision landing) was started. The jumping height was still 6,600ft, with the usual delayed openings of 23sec to 30sec, and excitement was intense, because this event would not only produce a "spot-landing champion," but would greatly influence the result of the Individual World Championship, which

HAD I BUT WINGS . . .

Kaplan in the act of winning the championship

is based on the total scores accumulated in Events Nos 1 and 3.

Accuracy was incredibly fine, despite the variable winds. Of the many different types of blank-gore parachute on view, the Bulgarian "triple gore" seemed the most efficient, but equally good scores were made with all types of equipment, and those competitors with less manœuvrable canopies had obviously gained sufficient experience to compensate for any technical disadvantage. Landing within 10m of a target point requires considerable skill, but once you are closer than 5m a small element of luck is involved in your final touchdown. Any violent turn close to the ground may cause a swing which can deposit one fifteen or twenty feet away. In these circumstances, the ideal parachute is one that will turn quickly without swinging violently.

In order to gain extra distance it has become customary for parachutists in competitions to land with their feet thrust well forward. The first point of contact with the ground is measured as your landing mark, and a jumper with long legs can gain more than a metre using this technique. Unfortunately, it invariably means that you touch with your feet and then skid on your seat, and this can be far from pleasant—as several competitors (including the writer) discovered to their cost. As the event progressed, bruises became more tender, and several people thudded into the target and lay there until friends lifted them stiffly to their feet.

The British scores steadily improved, with Tony Charlton as the most consistently accurate member of the team. The experts from Eastern Europe, France and the USA were averaging 3m to 5m with the potential champions being less than 1m from the small (4in) metal stud that indicates the target centre. Shortly after Dick Fortenberry made history by landing on the stud, Monique Gallimard of the French women's team casually floated in and produced an identical score!

The second jump was very similar, but the third took place in maximum wind conditions, and the women were stopped from jumping. Parachutists were opening 900m upwind of the target, and in some cases were still overshooting due to last-minute gusts. All British competitors were well inside the circle, but we hoped that this would be the jump we could discard.

Loy Brydon, the American team captain, nearly collided with a Rumanian jumper whilst they were both steering for the cross, and, in trying to miss him, landed 13m away. The mishap was due to the very fast rate of descent of the American TU blank gore, which caused Brydon to overtake the other competitor, who had jumped before him from another aircraft.

Five minutes later, Fortenberry became involved in a similar incident with Ostrovski. By making a rapid spiral turn he shot past the Russian and landed 4m from the centre, but in so doing dislocated his elbow. Ostrovski, with the air sucked from his parachute by the American's canopy, thudded down 30m away. He requested, and was granted, a further jump, to be taken at the end of the programme.

Saturday passed, with the Americans playfully doing wind dances, and the Russian and Czech trainers glancing anxiously at the wind sock and requesting met. forecasts. The calmest man in the midst of this suspense was undoubtedly Fortenberry and one would not have guessed from his composure that only the wind stood between him and the title of world champion.

The Sunday morning dawned with not a puff of breeze, and the final round started at 6 a.m. Fortenberry's arm was far too swollen, and there was no question of his jumping. Despite the apparent calm, there was a breeze blowing freshly above 100ft, and this increased slightly as the morning progressed. Openings were made approximately 300m from the cross and most jumpers crossed the edge of the circle at about 400ft.

The Bulgarians had kindly modified my parachute for me, but I misused it on the final approach and landed 13m short of the centre, thus raising my average to 9m. Denis thundered in to 21m, and Tony achieved an excellent 6m. Alf, unfortunately, misjudged his opening point and did not score.

Then it was time for Anikiev to make his bid, and the whole airfield seemed hushed, as people waited to see whether he would beat 1½m. A final turn was, perhaps, left too late, and he landed 5m to the side of the cross.

Kaplan jumped next and made his customary zig-zag approach. When he was 30ft above the cross the wind suddenly diverted the smoke from the constantly-running signal generator and sent it towards the target. The Czech continued on course and touched-down 2½m from the centre, to the relief of the Americans, who now felt confident that Fortenberry was safe. However, gamesmanship can be applied to parachuting, and Kaplan requested another jump on the grounds that the smoke had impeded him. The judges agreed, whilst Fortenberry's supporters hurriedly wrote protests to the jury of appeal.

On the second jump Kaplan showed what an experienced performer he is. Profiting by the lessons of his previous jump, he held off from the target until he was down to 300ft, then drove in on a curving approach, and made a final half-turn to slow his rate of drift. With the whole Czech contingent whooping with excitement, he casually made a stand-up landing *three centimetres* from the centre. And so Zdenek Kaplan became individual world champion with Fortenberry second, and Georgui Galabov of Bulgaria third.

I was not in a position to judge the influence of the smoke on Kaplan's first attempt, but observers who were close to the cross say that the target was obscured from the ground. For the next ten years, parachutists will debate whether it was also obscured from the air, but the international jury—after long debate—voted that Kaplan's protest was valid, and the results are now history.

The British scores for the spot landing were:—

		points
Charlton	7m, 12 m, 6m	= 512
Reilly	10m, 4½m, 13m	= 503
Lee	31m, 37 m, 21m	= 319
Card	94m, 79 m, 96m	= 19

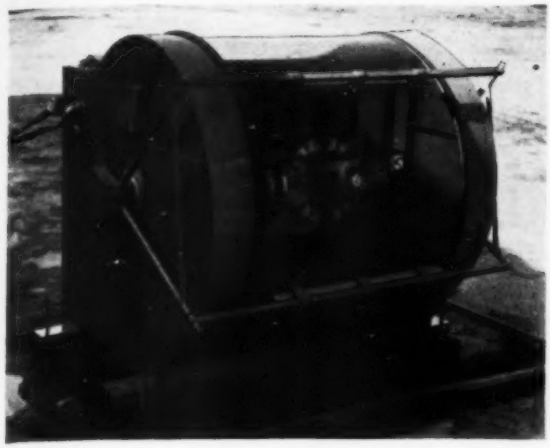
The event was actually won by Kaplan, with Vodenicherev (Bulgaria) second and Anikiev (USSR) third. An interesting point is that Vodenicherev, who, as winner of last year's Adriatic Cup tournament, was expected to do well, lost all points in the sky-diving event and so finished low down the final list of overall individual placings.

In the final individual placings, the British positions were: 25th, Charlton, 866 points; 27th, Reilly, 838; 41st, Lee, 472; 44th, Card, 84.

The women's championship was won by Bojena Rejzlova of Czechoslovakia, with Vera Zubova (USSR) second and Rosena Rybova of Czechoslovakia third. In the team event the Czech girls triumphed with 519 points, Russia was second with 484 and France was third with 479.

There were only four injuries in the tournament—the most severe being a fractured leg—and in three cases they may be partly attributed to the fast rate of descent of the American TU blank gore.

Although they have collected no trophies, the British team are well satisfied. We have improved our rating considerably since 1958; have acquired invaluable knowledge to be spread abroad amongst the British clubs, and—of great importance—the Bulgarians have actually exchanged one of their fine parachutes for my own moth-eaten "brolly." With this as the model for future equipment, we look forward to better things in 1962.



The projector unit of the new Airtech Ltd cloud-base recorder, now going into production. The rotating slotted disc by which the 900c/s modulation is formed is clearly visible. Outside the plastic window are the rubber snow-clearing blades

FLIGHT SYSTEM SURVEY

New Decca Displays at Farnborough

To be shown by Decca Navigator at Farnborough are the new Omnitrac computer converting Decca hyperbolic to rectilinear co-ordinates and a new distortionless map system such as has been proposed for the D.H. Trident. This will use Doppler with a rectilinear chart overprinted with Decca hyperbolae and periodically up-dated by Decca signals; or monitored by VOR/DME; or monitored by rectilinear Decca.

Airtech Cloud Base Recorder

Now going into production is the new cloud-base recorder designed to a Meteorological Office specification by Airtech Ltd of Haddenham, Bucks. It consists of three units, transmitter, receiver and recorder and is designed to record continuously on a chart the height of the cloud-base derived by triangulation from a scanning transmitter using a modulated light beam. The transmitter sweeps a 2°-wide beam of light modulated at 900c/s through an arc between 10° and 85° from the horizon. When this light intercepts cloud, the reflection is detected by the vertically aligned receiver unit 350ft away from the transmitter, the receiver being gated by a reference phase signal from the projector. When a cloud reflection is received, the angle of the light projector is sensed and fed with the received signal into the recorder. The height of the cloud, calculated by normal triangulation, is then displayed on a strip chart recorder remotely located in the control tower. With a 350ft base line between projector and receiver, cloud-base up to 4,000ft can be recorded. The chart recorder incorporates a quickly removable cassette of paper which will run continuously for ten days, providing a permanent record. A small c.r.t. in the control unit allows accurate setting of the phasing between reference and signal; and the received signal may be attenuated to reduce clutter on the chart. Complete control and failure warning lights are also centralized at the recorder. All links between the three units can be by GPO land-lines.

The transmitter projector consists of a precision light source modulated by a slotted rotating disc, the 2° beam being formed by a concave mirror on a common mounting, the whole unit being swept through the required arc by a motor-driven cam. The output of a photoelectric cell which detects the modulated light is amplified in a tuned receiver. A magslip on the mirror assembly transmits the beam angle to the recorder pen. The whole unit is mounted in a sealed case behind a curved plastic window which may be swept by rubber blades for snow clearance. The container is heated and ventilated and when the projector is switched off it automatically stops in a position in which sighting holes and the bulb are lined up for precise adjustment. When the case is opened, the reference amplifier may be unplugged and the complete mechanical assembly can be pulled out on integral rails for servicing. The 900c/s modulation is produced by the slotted rotating disc which is driven by a synchronous motor from the mains supply. Other mains frequencies may be accommodated by altering the number of slots in the disc—a simple modification.

The receiver consists of a photoelectric cell centred opposite a vertically aligned concave mirror housed, with reference phase unit and related circuits, in a sealed container behind a sloping plastic window and a collimator excluding direct sunlight.

Production of an initial batch of 15 of these cloud-base recorders has now begun, the unit having met Meteorological Office specifications. Firm orders are on hand for five and considerable interest has already been aroused both in Britain and abroad.

USAF Uses Teaching Machines

A TEST group of 14 USAF personnel are taking a 15-week electronics course under the sole tuition of individual teaching machines developed by the Western Design division of US Industries Inc. A second group will take the same course under normal tuition and the results are to be compared. The experiment is designed, according to the USAF Directorate of Personnel Procurement and Training, to investigate the possibility of reducing the training load imposed by complex modern equipment.

The machine being employed is the AutoTutor shown in London at the recent Electronics and Automation exhibition. It has two innovations, namely, that while requiring the student to show understanding at each step of the course, the machine lets him advance as slowly or as rapidly as he is able. At the same time, it automatically records his progress and charts his reasoning process. Each student has his own machine, looking like a television set and computer combined, on which he is shown a page of information including pictures and diagrams on an 8in×11in screen. After studying the material the student must answer a multiple-choice question by punching a code number on a keyboard similar to that of an adding machine. A new page of information appearing on the screen then either verifies his answer and proceeds with the course or explains his mistake and directs him to select another answer. Moving pictures are also shown.

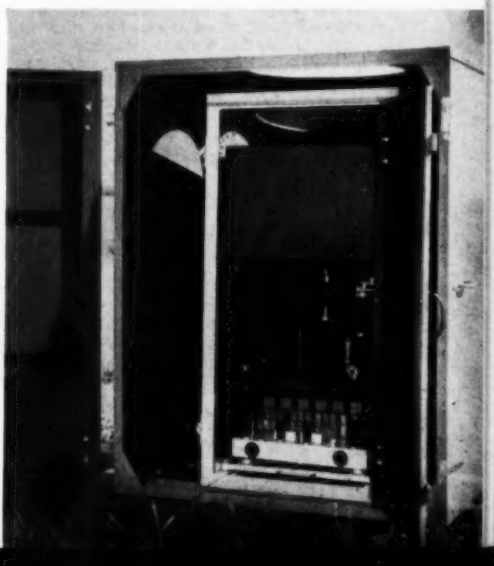
Each student's answers and the time he took in selecting them are automatically recorded for subsequent analysis. The test is being run jointly by USAF Air Training Command and by the Behavioral Sciences Laboratory of Wright-Patterson AFB.

Swedish Master Gyro

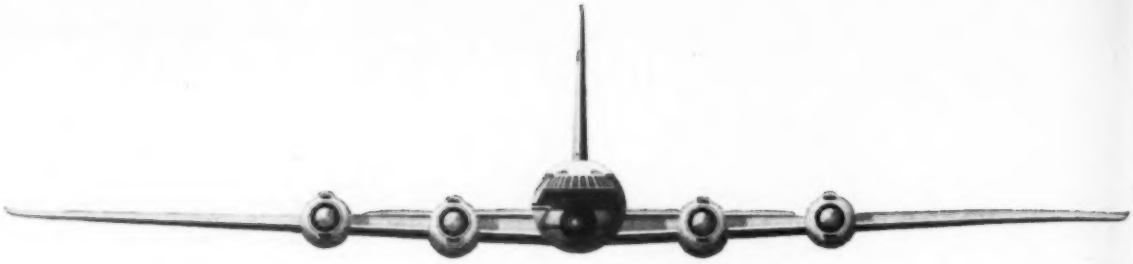
THE AGA Company in Sweden has produced a master reference gyro for fighter aircraft designated FLI-25. The gyro unit is enclosed in a hermetically sealed, helium-filled case and has servo-operated gimbals which maintain the gyro horizontal regardless of aircraft manœuvres. There is also a "parallel guiding device to prevent angular errors due to lurches," according to the initial Swedish description. Azimuth, roll and pitch angles are sensed for flight instruments, autopilot, gun-sight and, probably, radar. A magnetic flux valve unit also provides magnetic heading for a compass presentation. A globe artificial horizon is used.

Edo Loran Sales

THE lightweight Loran receiver produced by Edo Corp, described in *Flight* for May 6, is now being used or has been ordered by 25 airlines, including TWA, Iberia, El Al, TAI and Garuda. Indicator, control panel and rack-mounted unit weigh 31lb and position lines can be directly read from the control panel. If required, two indicators can be fitted to allow reading of two position lines simultaneously.



The vertically aligned mirror assembly of the receiver unit of the Airtech Ltd cloud-base recorder described on this page. The unit is normally sealed inside the inner container, the doors here being open for servicing

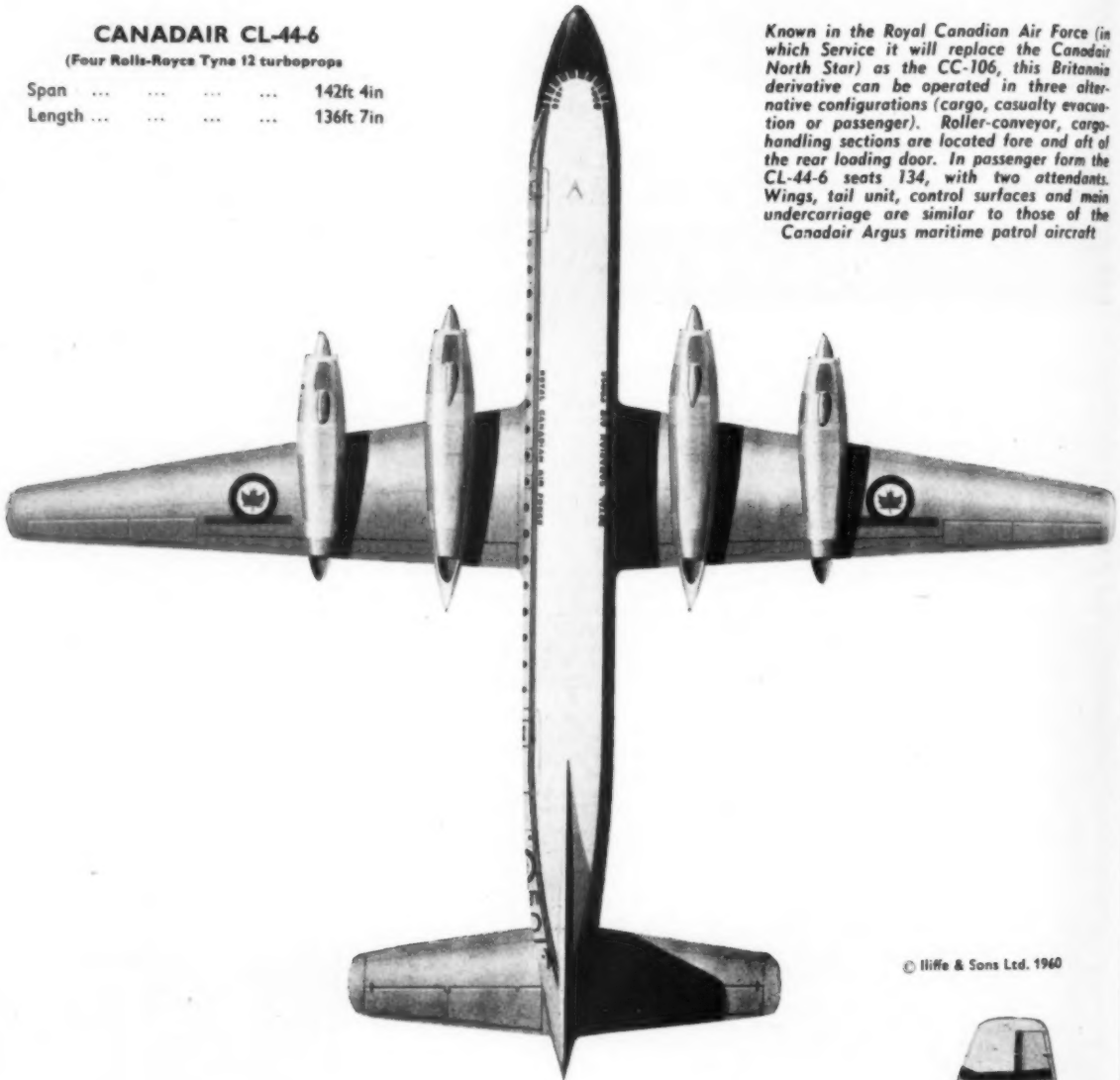


CANADAIR CL-44-6

(Four Rolls-Royce Tyne 12 turboprops

Span	142ft 4in
Length	136ft 7in

Known in the Royal Canadian Air Force (in which Service it will replace the Canadair North Star) as the CC-106, this Britannia derivative can be operated in three alternative configurations (cargo, casualty evacuation or passenger). Roller-conveyor, cargo-handling sections are located fore and aft of the rear loading door. In passenger form the CL-44-6 seats 134, with two attendants. Wings, tail unit, control surfaces and main undercarriage are similar to those of the Canadair Argus maritime patrol aircraft



© Iliffe & Sons Ltd. 1960

JET NOISE and Society

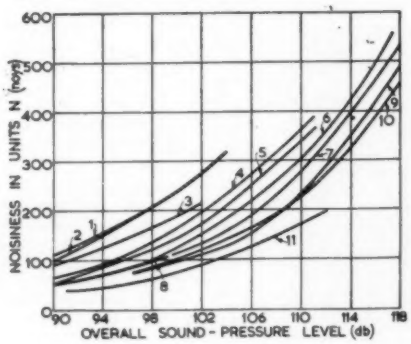
A CASE FOR FULLER INFORMATION?

by J. M. Ramsden

THIS is the time of the year when movements at London Airport are at their peak, and when the consequent disruption of family life, business, schooling and so on is at its least tolerable. A contributor to the *New Statesman* for August 6 wrote: "Having now listened (in a Harlington back garden) to the noise they leave behind them I think these jets produce the most terrible noise yet invented by man."

Again, in a joint letter to *The Times* on August 10, representatives of six London Airport residents' associations took sharp issue with an article in that newspaper which, in essence, had suggested that the noise problem was being exaggerated. The residents are waging their battle—as their letter to *The Times* shows—with well informed arguments; the only emotional content of this particular quietly reasoned rebuttal was: "We think the limit of the tolerable has been passed when a child woken in the night by a jet cries out—'No more noise! No more noise!'" These public protests will continue, and they are likely to become more, rather than less, bitter as jet traffic increases.

Jet noise curves based on Bolt Beranek and Newman data. Key: (1) Comet 4 landing; (2) Boeing 707-120 landing; (3) DC-8 landing; (4) Boeing 707-120 take-off, reduced thrust (8,000lb); (5) Comet 4 take-off with reduced thrust (5,600-6,000lb); (6) Comet 4 take-off, full thrust (10,500lb); (7) Boeing 707-420 take-off 15,020lb thrust; (8) average piston-engined aircraft landing (DC-7, DC-7B, DC-7C, DC-6B, Super Constellations 1049 and 1649); (9) DC-8 take-off 13,000lb thrust; (10) Boeing 707-320 take-off 13,500lb thrust; (11) average piston-engined aircraft (types as above) take-off



What does it cost a jet operator to reduce noise? The answer to this question, wherein lies the essence of the jet noise problem, can be determined in general terms. The price to a Boeing 707-320 can be as high as 10,000lb of fuel or payload per decibel, and to a DC-8 (JT4A-9) it is of the same order. Roughly speaking, the db is here interchangeable with the PNdb—the "perceived noise" decibel that is now the standard measure of jet noise at London and New York. These rough estimates assume the aircraft concerned to be at full power about three miles from the start of take-off roll. In practice at London, everything depends on the noise limitation (110PNdb by day) set by the Ministry of Aviation; the position of the Ministry's noise control monitoring points and the length of the runways concerned; the power-cutback techniques evolved by the operators; and other factors. It is therefore not easy to arrive at an estimate of the economic penalties incurred in practice. So far they have probably not been severe: certainly there have been no public protestations from the airlines, the great majority of whose crews have complied with the letter and the spirit of the Ministry's rules. The economic penalty of noise suppressors, however, can be measured with a fair degree of realism: the airlines seem generally agreed that these devices reduce thrust, increase fuel consumption and decrease payload by amounts ranging between one and two per cent in each case.

Although the Ministry's noise rules do not have the force of law behind them, as do those of the US Federal Aviation Agency, something like 85-90 per cent of all jet take-offs are monitored by the Ministry of Aviation at the control points indicated on the map overleaf, and the Ministry does not hesitate to reprimand

LONDON A[IR]T, [HE]

Approx[imate] [dis]t (+) [fr]om

Ministry of Aviation Crown copyright [re]s[er]v[ed] — cont[rol]
the key map, approximate distances fro[m] [ta]k-off be[gin]

(1) Longford; (2) Southern ATC; (3) T[er]m[inal] [for] jets ban[ned]
LAP Central; (4) LAP North; (5) Bath [Ro]ad [Ga]rage [to]
Harlington; (7) Cranford; (8) BOAC; [(9)] Site [of]
(10) No. 1 maintenance area; (11) [Ha]ngars; [Run]way 10R/2[8L]
05R/23L; (12) Runway 4, 15L/33R; [Pan]Am [ha]ngars;
apron; (14) Queens Building; (15) [Ho]use; South [Wes]t
terminal; (16) Control tower; (17) [Ho]use; [Bur]nham[-on-]
haul terminal; (18) Runway 1, 10L/[28R]; [Ter]minal;
Runway 6, 15R/33L; (20) Runway [10]L/[28]R

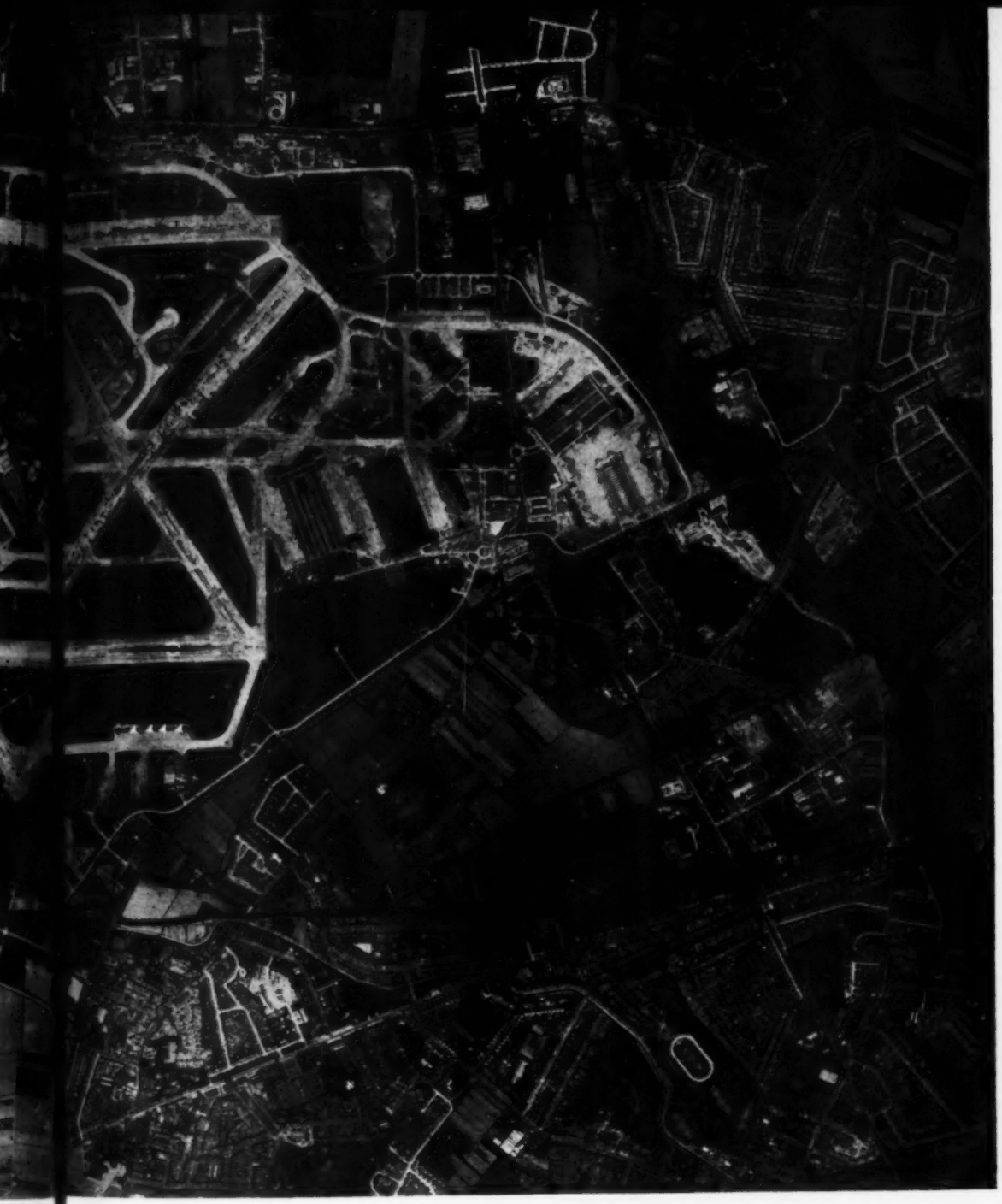
JET NOISE and Society . . .

offenders. Like Customs, even though it is not 100 per cent thorough, noise monitoring has a deterrent effect upon any would-be offenders.

In fact there appears to be reasonably satisfactory co-operation between operators and the Ministry—notwithstanding the publication of night jet schedules, and the selling of seats, by BEA, Swissair and SAS in apparent contempt of the Ministry's "no night jets without noise tests" rule. The effect of those incidents on the London Airport's residents was unfortunate, for reasons that will be examined.

But first to put matters into perspective, it must be accepted that the Ministry cannot completely silence its critics, the airport residents, any more than it can completely silence the source of

(Continued on page 302)



ON AT, May 1960

Approx [illegible]k (9¾ st miles)

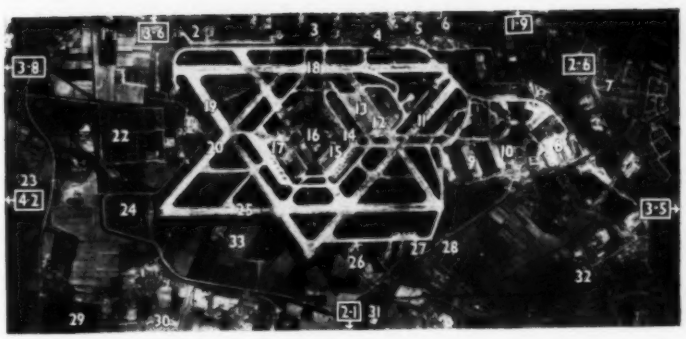
copyright

e control points are shown by the squares on stances fro[illegible] -off being indicated in miles inside the squares

ATC; (3) T[illegible]; (5) Beth[illegible]; 8) BOAC; [illegible]rea; (11) h[illegible] 15L/33R; [illegible]ing; (15) H[illegible]er; (17) H[illegible]y 1, 10L/[illegible] Runway 7,

ghts banned 05L); (21) Fuel farm; (22) Perry Oaks ewage works; (23) To Stanwellmoor village; 4) Site for extension to Runway 5; (25) Runway 10R/28L; (26) No. 2 maintenance area; (27) nAm hangar (note RAF Vulcans); (28) Great outh West Road; (29) Staines reservoirs; (30) tonwell; (31) East Bedfont; (32) Feltham; (33) No 3 maintenance area.

=Mid-reservoir control point



Ministry of Aviation technicians monitoring jet noise in Windsor Great Park

JET NOISE and Society . . .

their affliction, the jet airports. It can do the latter only by closing the airports, which would be absurd. The best that the Minister can do is to attempt to keep the noise within reasonable limits, having first defined what is "reasonable" by technical research. Technical research into aircraft noise, and human reaction to it, is the prerequisite—and there is no doubt that British work in this field is considerable. It has been more thorough than is generally supposed; indeed, the widely held belief that the Ministry has based its noise policy wholly on American (Bolt Beranek and Newman) work is not correct, as will be shown.

The Ministry must accept much of the responsibility for the undoubted lack of public confidence in its efforts to regulate jet noise. The problem is not only technical: it is also one of public relations. Once the technical basis of a noise-regulation policy is established, good public relations can be a most effective means of putting across that policy. It is this point that the Ministry appears to have so far overlooked.

Examples of Some Misunderstandings

(1) Until June 1, when the PNdb measure of noise was introduced, it appeared that the Ministry considered the db a satisfactory measure—notwithstanding the fact that New York had rejected it in favour of the PNdb more than 18 months previously. This impression was given by the Minister's statement—vehemently contested by the residents—that a 97db limit for jets was less noisy than that of piston-engined airliners that operate at night.

What the Minister did not say until much later was that he was basing his estimate on a 105db piston-engine level, which in PNdb terms is perfectly reasonable—except that the conditions of the 105db measurement have not been specified (two miles from start of take-off roll? Three miles? Four miles? Fully loaded Super Connie or lightly loaded DC-6?).

The consequent misunderstandings, in particular the belief that the Minister was sponsoring the misleading decibel, need not have arisen had full information been available.

(2) Noise tests of BEA's Comet 4B, and of the SAS-Swissair Caravelle, were indeed carried out. But public suspicion that the Minister was merely going through the motions (an inevitable suspicion in view of the fact that the operators concerned were already advertising and taking bookings for night jet flights) was heightened by the Ministry's refusal to publish details of the tests. What were the db measurements? Which runways? What power settings? What weights? Suppression of this information, which is essential to a proper assessment of the validity of the tests, suggests either that something is being concealed, or that the tests were lacking in thoroughness. We have the Ministry's assurance that neither of these doubts is warranted: one is therefore left with the impression that here is another avoidable communications failure.

(3) The Ministry's adoption of the PNdb, an invention of US acoustical research, was warmly welcomed as a great leap forward. What the Ministry has failed to put across is the work done checking US work—and carrying it further—by its engineers in the National Gas Turbine Establishment in co-operation with the National Physical Laboratory. *Flight* readers may recall an account of the NGTE's fascinating subjective tests into human reactions to jet noise. The establishment had a display at the last SBAC show at which 1,600 volunteers participated in a large-scale experiment on the subjective effects of aircraft noise. The subjects, ranging in age from under 10 to over 70, responded to the experiment in a way which subsequent analysis showed that the US [Bolt Beranek and Newman] "empirical method for assessing the perceived noise level is adequate for comparison of existing types of fixed-wing aircraft." This quotation comes from the January 1960 issue of the Royal Aeronautical Society's *Journal*.*

* "*A Controlled Experiment on the Subjective Effects of Jet Engine Noise*," *by W. C. T. Copland (NPL), L. M. Davidson (NGTE), T. J. Hargest (NGTE), and D. W. Robinson (NPL).*

This was a paper that deserved circulation wider than among subscribers to a professional journal. A simplified summary would have scotched much of the public scepticism that has existed about the technical basis of the Ministry's noise policy.

(4) In adopting PNdbs, why not Ns (noys)? The N is the arithmetical analogue of the logarithmic PNdb, and as such it is much more comprehensible to non-technical people—who comprise 99.9 per cent of the public whose interests the Ministry is, in the final analysis, protecting. If the PNdb is scientifically acceptable, *ipso facto* should N be acceptable. Ordinary people find $2 \times 2 = 4$ a much easier sum than $10^{\cdot 301} \times 10^{\cdot 301} = 10^{\cdot 602}$.

Of course, two people might dispute that a given noise of 200N was twice as noisy as one of 100N. But if the empirically derived PNdb is scientifically viable, the N must be too. The point is this: to talk in terms of 200N and 100N is better public relations than to talk in the analogous, but much more obscure, terms 116 PNdb and 106 PNdb.

(5) Though the Ministry has set 110 PNdb as the limit by day it has not published the noise limit applied during sleeping hours, when a noise of 110 PNdb—or any noise—is much more disturbing than it is by day. For the time being, jet operations are limited to a small number of European operators, and the Ministry has indicated that the night limit is less than 110 PNdb. But why cannot the actual figure be published? What is there to hide?

Noise is recorded in the field (see map, page 301) by broadcast-quality tape-recorders (right). After processing by octave-band filter, amplifier and time-recorder (top to bottom), PNdb figures are then calculated. Each jet take-off takes 20 minutes to process in this way in the MoA laboratory; about 90 per cent are monitored, i.e., 1,000-plus per month in the summer

These are a few examples of the misunderstandings that have exacerbated an already difficult enough problem. The case for fuller public information is a strong one. The familiar phrase "public interest" often defies definition, particularly when the publication of information concerning national security is involved. A Minister can often evade an awkward question by saying that publication of the required information would "not be in the public interest"—and he is then exempt from further public accountability. But he can hardly say that fuller information about jet noise would not be in the public interest. There is no doubt about the meaning of the phrase "public interest" in this context: the public wants to know what is being done to protect family life from disruption by the greatest noise that our commercial civilization has ever produced, and to which society may not become tolerant, in the medical sense, as it did to the products of the Industrial Revolution.

Airline Fares

WHAT PRICE GOVERNMENT APPROVAL?

By H. AIREY

WHY do governments dabble in air transport? This is a question which should be asked more frequently. Most people have probably forgotten that as recently as 1944 Australia and New Zealand made serious proposals for what would have been virtually a single world airline for international services. Today this would be a lunatic pipe-dream.

Yet how many governments have recently examined their motives for being involved in air transport? Even more rare is to find a government which has psychoanalysed its mighty-airline complex and published the results. What are they all doing?

The first thing to realize is that each government will have to reach the Big Decision all on its own. Some say it is a question of prestige. Others say they must back up a manufacturing industry. "A strategic reserve," say the gunboat school. Please don't laugh —this is serious. Probably the best argument is that existing aeronautical skills and enthusiasms ought not to be dissipated once they have sprung into existence. They are then part of a nation's resources, which ought not to be frittered away unless they can be diverted to other allied purposes of a more urgent character—like manufacture in a genuine world market.

Once the decision has been reached to get involved in international air transport, either with a State airline or by giving opportunities to private enterprise, the government is in business —Big International Business. From there on one might expect some recognition that the government's rôle in international airline price policy, is, frankly, a policy of self-protection. As pointed out by the Air Brokers' Association in their pamphlet *Freedom in the Air*, one of the few occasions on which governments adopt very frank protectionist methods is when they wish to protect their national scheduled carriers from foreign charter operators.

Is control of air fares a form of protectionism? If the answer is "Yes," then it is clear that too many governments have overlooked other means of pursuing the same ends. Why not have a tariff against foreign carriers? Or, as was suggested in a recent article in *Flight* (March 24, 1960, page 874), make one government pay to another Foreign Traffic Credits for each unit of traffic carried by the other's airlines?

If the answer is "No" then there must be other excuses for government interference in the realm of airline price policy. Each government is ultimately responsible to its own group of patient taxpayers. There must be a justification in terms of overall public benefit. It cannot simply be to protect the airlines from accusations of creating an international cartel. If price-fixing by trade associations or commercial groups is against a particular nation's policy domestically it is hard to see why it should be justifiable on an even wider scale. Removal of government approvals would expose IATA rate recommendations to all these accusations. Is this why governments retain ultimate control? Is it to prevent a price-war resulting in either lower standards of safety—or worse still, a subsidy-war? Can it protect the travelling public against paying too high a price?

The answer seems to be that it has all these effects and yet it is not truly justified solely for any of these reasons. Government approval of international air fares is a device for the protection of governments' policies in air transport.

Why should governments have to justify their policies? One reason is that the rising tide of education produces an uncomfortable sea of questioning voices. New generations are not content to follow their elders and betters without asking beastly questions. Why is my government doing these things? Is it for me? A world is full of angry young men who will in their turn harden into irascible old buffers.

It is easy to see that it is very convenient for the world's airlines to agree upon a standard fare-structure. It makes the calculations of traffic staff and travel agents easier when this is combined with the use of interchangeable tickets. But it is not impossible to work with separate fares for each airline, though very inconvenient. Advances in automatic data processing might help.

If there was international competition in airline prices would safety standards suffer? Not if the governments fulfil their obligations to each other in the matter of ICAO technical Annexes. Safety today is recognized as so important that it is dealt with solely by the enforcement of stringent regulations and *not* by controlling price policies. Safety is not an article of commerce. It may be bought by the airline but it cannot be sold to the public. Would competition in international airline fares lead to subsidy-wars between governments? Of course it might. But that is an inevitable consequence of the government's decision to dabble in air transport. Absence of fare-competition has not prevented subsidy competition. No two governments today have the same policy about subsidies and that is as it should be. So there is no real reason for supposing that fierce economic competition would alter the situation in principle. It would accentuate the harsh realities of governments in Big Business. It would lead to an excellent, soul-searching examination of the government's motives for being "in" air transport. It would *not* mean that the wealthiest country, able to pay the largest subsidies, would thereby scoop the world's markets. Not if the governments clearly recognized their protectionist rôles and adopted flexible means of pursuing protectionist policies by tariffs, foreign traffic credits and so on.

What should governments do? Let's pretend that governments read magazine articles. Each government with an active interest in international air transport must be prepared to justify its activity to the domestic audience. The justification will have to appeal to the general public benefit and the flexible preservation of economic potential. If the motives are compatible with the demands of the national economy the government must make clear its choice of protectionist methods available. The trend of public conscience is *away* from price-fixing by trade associations or monopolistic groups.

Any government which is not prepared to examine its own motives honestly in these terms should quit the exciting field of air transport and stick to the conservation of ancient monuments.

CIVIL AIRCRAFT: A DEFINITIVE WORK

British Civil Aircraft, 1919-1959, Vol. 2, by A. J. Jackson. Putnam & Co Ltd, 42 Great Russell Street, London WC1. Price 63s. Illustrated.

THE second volume of Mr Jackson's massive record of the complete British civil aircraft register has been awaited with some impatience by all those enthusiasts who acquired Volume 1 last year. Now that it has been published, the complete work can be admired in its entirety and individual tit-bits of detailed information from this cornucopia of British aviation history can be selected and savoured at will.

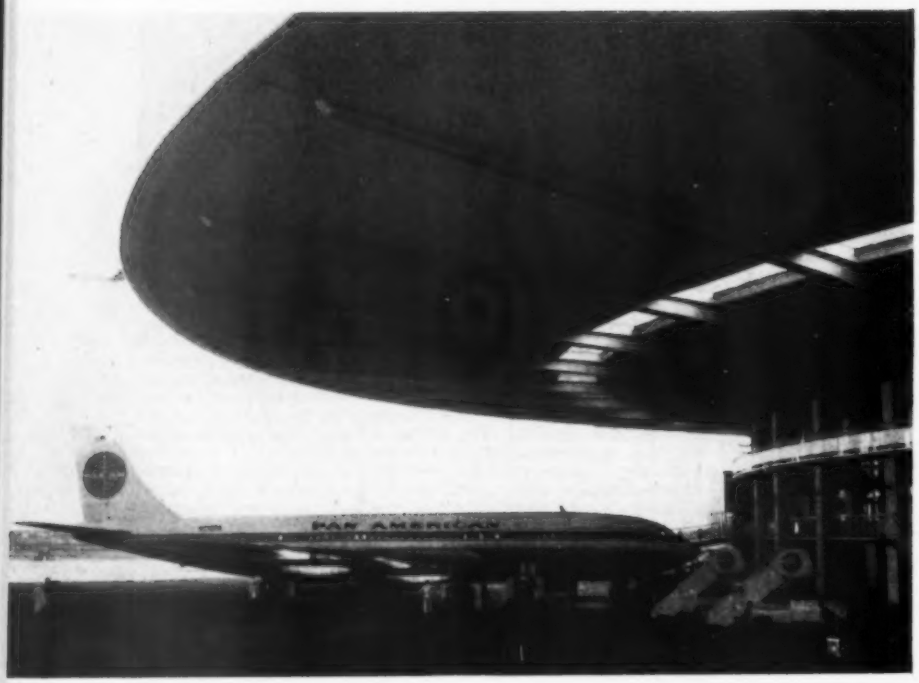
Delving into this second volume, one is again impressed with the high standards of accuracy and of completeness which Mr Jackson has achieved. This work is the result of many years of careful recording and accumulating of detailed information about countless individual aeroplanes and it has been compiled into its final published form with that same enthusiastic care as has been applied to the collecting of the basic information over the years. The result is a model to anybody who may attempt such a task in other fields—certainly this work is likely to be accepted as definitive in its own. It is difficult to foresee a requirement in the future for anything more than Jackson slightly revised.

One's only hope is that new aircraft types recorded in future editions will have happier fates than the majority of British civil aircraft seem to have had in the past. Presumably the many crashes recorded in both Jackson's volumes are the inevitable consequence of a treatment which concentrates on the main events in the careers of individual aircraft. Even so, to anybody who flies light aeroplanes, it is sobering to find what a high proportion of British light aircraft, in the past, have come to sticky ends.

It seems to be customary, in reviews of this kind of book, for the reviewer to demonstrate his own extensive knowledge of the subject-matter by listing the many errors which he has uncovered. The present reviewer has neither the knowledge nor, indeed, the inclination to adopt this technique. In any case, it is doubtful whether a complete list of the errors in *Civil Aircraft* would be anything very impressive. True, Mr Jackson is wrong in saying that the original V.701 Viscount had a 53-passenger layout (it was 47) and that H.P.45 was not the contemporary design number of the Heracles, even though it was not used as the type's designation. It might also have been said that more space should have been devoted to the Supermarine Sea Eagle flying-boat and to the historically significant H.P. W/8E and F; but none of these is more than a small point of detail.

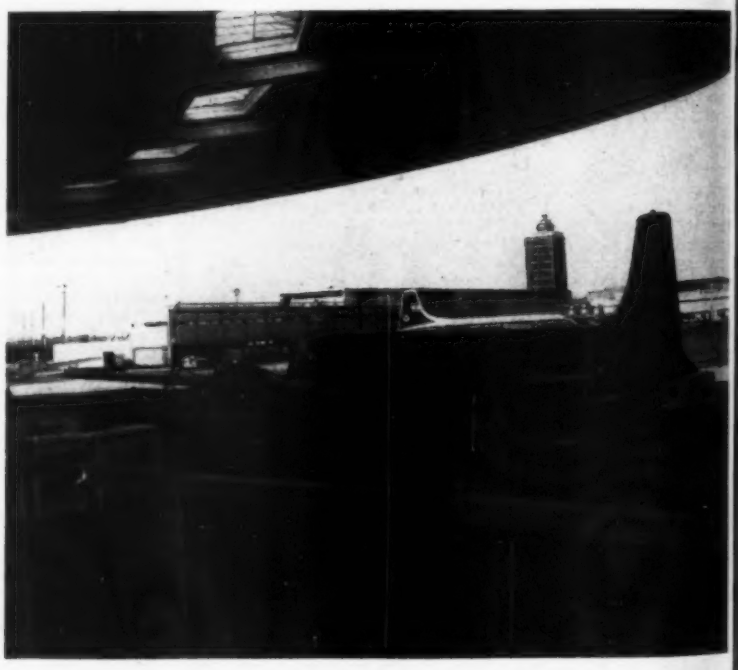
If Mr Jackson is to be reproved at all it would be in respect of his quite inexplicable use of the incorrect abbreviation "B.E.A.C." Even the most anti-nationalization elements of the daily press have long since been converted to the consistent use of BEA's selected—and much advertised!—abbreviated title while, years ago, the former British Electricity Authority had its name changed to Central Electricity Authority for the same reason.

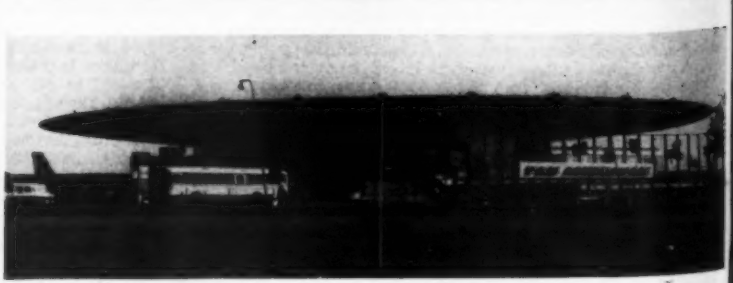
PETER W. BROOKS



PANAMERAMA

PAN AMERICAN AIRWAYS' solution to their passenger handling problems at Idlewild Airport, New York, is this circular terminal with four-acre overhanging roof, guaranteed to keep the customers dry. Costing some £4m. and forming part of the great Port of New York Authority Airport complex, it was opened by the airline in June. Eight road traffic lanes allow more than 30 cars or taxis to load or unload every minute and apron space is sufficient to handle eight big jets an hour. In the photograph below, the terminal—and a DC-7—is shown in relation to the main airport buildings and the two interior views on the left show the "dining lounge" and (lower) the conveyor belt which carries passengers' luggage up from the apron.





US Election-year Policies

DEFENCE IS *THE* ISSUE

BY DON ADAMS (New York)

EARLY in November unprecedented numbers of Americans will go to the polls to cast their votes for a new president. The two primary candidates for America's highest office are, of course, Vice-President Nixon and Senator Kennedy. The question of which of these men will guide America's fortunes during the next four years has already become a subject of absorbing interest in the US, if not throughout the entire world. Public-opinion surveys have failed to credit either nominee with a decisive lead, and there is evidence that many people have not yet established their individual preferences. Realizing this situation, both men are already campaigning mightily to gain the uncommitted votes. A key, if not "the" feature, of both the Republican and Democratic platforms is a pledge to increase the US's defensive strength. The Democrats allege that, under the present Administration, America has lost her once pre-eminent position as the world's strongest nation. While decrying these statements as being sheer campaign oratory—and at the same time cautioning that such reckless haranguing may mislead one of the unfriendly powers into committing some foolhardy action predicated on US weakness—the Republicans themselves have called for renewed emphasis on defence preparedness. The Administration announced in early August that more money would be spent during the 1961 Fiscal year (which began on July 1) than had been originally planned. This move unquestionably was prompted by an awareness that this year is an election year. And significantly greater sums of money will be appropriated for defence in next year's budget. The two contending parties in the election have voiced different opinions as to exactly how much more money should be spent, but it would appear that, irrespective of who becomes president, vast changes will be made in America's defence posture. Budgetary increases of as much as $3,000 million (to $43,000 million) have been discussed for the Fiscal '62 defence budget.

Pentagon Looks Ahead

Anticipating increased funding, Pentagon planners are already weighing the needs of various programmes. Below are discussed some of the more notable revisions even now being contemplated.

Although there are many who doubt the existence (now or in the future) of any appreciable Soviet numerical superiority in ICBMs a majority of the US military and civilian population now favour an expansion of America's ballistic missile inventory. Several justifications are given for such action. Intelligence activities had some time ago concluded that Russia *could* acquire an ICBM lead in the early 1960s *if* she chose to divert a substantial proportion of her uncommitted resources to this specific field. Whether or not the Soviets have realized a numerical lead is unknown by the general public; but the fact that the Russians *might* have a lead in ICBMs looms large in the minds of many people. And with prevailing world conditions, most Americans appear united in the demand that the US have *real* strength to counter *real or potential* Russian arms.

Accordingly, it is expected that all major US strategic missile programmes will be accelerated, some to a greater degree than others. The Polaris project (*Flight*, July 29) will unquestionably receive significantly increased funding. Recent successes with actual launches from a submerged submarine should speed operational deployment of the weapon. Earlier troubles have apparently been corrected and the programme is now well ahead of its original development schedule. Concurrent with an increase in numbers of missiles, additional submarines are to be constructed. The President recently announced plans to raise the level of submarine building to five submarines per year, instead of the present figure of three. The Navy has urged even further acceleration of the construction plan and would like to see Polaris submarines built on a one-per-month schedule. This rate would be maintained until 45 submarines were commissioned. Many neutral observers feel that any new Administration will lend a sympathetic ear to such a proposal. Perhaps as much as $9,000 million will be spent on the Polaris programme before it is completed some years hence.

The rather extraordinary recent successes of the Atlas missile will also likely result in increased funding for the weapon. The Atlas, being a liquid-fuelled missile, is a nuisance to launch and, being a thin-skinned missile, is vulnerable to nearby nuclear detonations. But the Atlas *works*, and it works remarkably well. Its accuracy is all but phenomenal. On the other hand, the ills of the Titan programme have been reported many times. Progress is slow with only occasional successes. Many prefer to see a few more successful firings before expanding Titan production.

The first Cape Canaveral launches of the Minuteman ICBM, the solid-propellant, second-generation missile are expected before the end of the year. The Air Force hopes for, and probably will obtain, sufficient funds to facilitate early deployment of this prized weapon system. Even the most pessimistic of the "missile gap" alarmists concede that when Minuteman becomes operational the US will have superiority in the ICBM field. Progress in the programme is reported to be good—so good in fact that many of the Air Force planners are already discussing the requirements for ICBM systems beyond the Minuteman.

For one reason or another, it appears that the US may ultimately be forced to withdraw her strategic (but not tactical) delivery systems from their overseas bases. Whether or not this will occur is problematical, but it would seem that military planners are aware of this possibility. Hence it is logical that emphasis will be placed on extended-range variants of the ballistic missile systems. The Atlas has been fired over ranges considerably in excess of its design value of 5,500 miles. It would therefore not be at all surprising if a production long-range Atlas were evolved. Similar plans may also be in order for the Titan and Minuteman. An 8,000-mile-range vehicle would enable any part of Russia to be reached from the US heartland (and vice versa), thus eliminating the need for reliance on overseas bases. Often discussed has been the Navy plans for a growth version of Polaris with a 2,500-mile range. The present 1,250-mile-range Polaris is able to strike only the outer fringes of the Soviet lands, since the launching submarines must lay several hundred miles off-shore for their own protection from enemy countermeasures. The longer-range Polaris, therefore, would have much greater freedom in the selection of targets.

Other strategic systems likely to be favoured with increased appropriations are the B-52/Hound Dog and the B-52/Sky Bolt weapons. Development of these weapons will further lessen the need for primary reliance on overseas bases. The Sky Bolt, in particular, seems to be the kind of weapon which should be speeded to operational use.

Ever since the public first became aware of the B-70 Valkyrie (M3) bomber programme, the projected successor to the B-52 bomber has been subjected to much criticism. Some months ago the Administration drastically cut back the project on the simple premise that this enormously expensive aircraft—some sources quote over $100 million per copy when all costs are included—was not worth the money. Ballistic missiles certainly would be operational in quantity by 1965, the earliest date at which the aircraft might become operational, according to some newspapers; and the missiles could destroy enemy targets at a far smaller cost-per-target-destroyed than could the B-70.

USAF Defends the B-70

The Air Force, necessarily, has hotly contested these arguments and have defended the B-70 on the basis that evolvement of the aircraft—even if it cost $10,000 million (total programme costs) —would require that the Soviets spend upwards of four times the B-70's cost to develop a weapon system capable of destroying the Valkyrie. That this contention may not be a sound one has been suggested by some; even the Air Force is aware of its argumentive nature, and have added the further assertion that the B-70 will prove useful as a prototype for a M3 transport. A further justification—which is somewhat difficult to understand—is the Air Force argument that the B-70 would be both a deterrent to, and a useful weapon for, small wars.

One very simple, but perhaps unstated, reason for building the B-70 is that the Air Force has always built bigger and better bombers! Such an explanation may sound unduly harsh, but military people are frequently dogmatic in their approach to some problems, particularly when the debate centres on "their" field. An interesting parallel is the case of the Navy battleships. The Navy steadfastly defended the ships' existence for many years—and built bigger and better battleships—until the war proved that they were not needed. Even today the Navy talks about bigger and better carriers, when it would appear that submarines may eventually replace surface ships as the primary striking force.

Be that as it may, the Air Force expects to, and undoubtedly will be able to, realize almost full reinstatement of the B-70. Perhaps some of the former lavishness will be curtailed, but Air Force persistence is wearing down the opposition. Few now doubt that the programme will be accelerated well beyond its present level.

Also likely to be favoured with additional funds is the MATS group. A jet airlift capability is being urged and will receive some support. The maintenance of an airborne alert should be possible with Congress fully in agreement that SAC should be kept airborne while the missile gap is being closed. The Army should

US Election-year Policies . . .

be awarded enough money to provide a greater small war capability. They are especially in need of close-support weapons such as anti-tank arms. The Army also hopes to obtain either better Air Force co-operation in close-support operations, or to gain permission to man its own light strike aircraft. For its part, the Navy seeks another super carrier in addition to the aforementioned Polaris submarines.

Almost certain to benefit from greater "defence" spending will be NASA, the civilian space agency. This group recently announced its ten-year programme, which included development of a vehicle called Appollo, which is to carry several men on a circumlunar journey. Also discussed were unmanned lunar-landing vehicles and planetary probes. The NASA plans are carefully considered, but perhaps over-cautious in light of previous developments. The ten-year plan calls for a lunar soft landing in 1963 and manned circumlunar flight by 1968. The 1963 date seems quite reasonable, but the latter date may be somewhat pessimistic. If all goes well, Project Mercury will orbit a man next year, or approximately three years after America orbited her first pint-sized satellite. It seems odd that in three years the US can progress from a small unmanned payload to a 2,500lb satellite, and then require seven more years to progress from orbital flight to deeper manned space penetrations. A good bet here would be that "space" is accelerated so that a manned lunar landing can be made before the turn of the decade. Manned flights to the vicinity of Mars are not totally beyond the realm of possibility, but require much more work. Such programmes would necessitate acceleration of the big booster programme, but one would imagine that the new administration would push the booster programme beyond current levels.

On the military side of space, it would appear that reconnaissance satellites will be given increased emphasis. Satellite interceptors represent another field worthy of increased funding.

Both candidates have urged that America stop being complacent, forget past glories and set forth on a bold new path in the future. Each has called for greater sacrifices in order to achieve the ultimate national objective which is freedom and peace throughout the entire world. Heretofore, national dedication and purpose were aroused mainly by external events, such as by a war or as occurred after the orbiting of the world's first satellite by the Soviets several years ago. Now, both nominees are urging that America take the initiative, rather than being prodded into action by some outside occurrence.

Which candidate will be elected is difficult to guess. Much depends upon world conditions at the time of the election. An interesting subject for speculation here in the USA is the effect that would be created by the orbiting of a man by the Soviets just prior to the election. There is reason to believe that the Russians have the ability to orbit a man and will do so shortly. During the AAS meeting in January (*Flight*, February 5) it was agreed that the Soviets would orbit a man this year—April was mentioned as the earliest date for such a capability. With Soviet awareness of propaganda possibilities, it might be that they are waiting to orbit a man just prior to election time so as to throw the US into turmoil. A further reason for such a move would be to attempt to "swing" the election to the Democrats. Many sources report that the Russians feel it would be to their advantage to have this party in power; the orbiting of a man by Russia would certainly weigh heavily in the minds of the voting public. Many would blame the present Administration for America's second place position and vote accordingly.

An interesting anomaly of this election year is that "Defence" is virtually *the* issue being discussed. Yet, both parties are notably united in both foreign policy and the means to achieve it. There are significantly greater differences in domestic issues; yet, defence overshadows everyone's thinking.

AIRCRAFT OF 1914-18: A VALUABLE RECORD

Fighter Aircraft of the 1914-1918 War, compiled by W. M. Lamberton, with drawings by J. D. Carrick and F. Yeoman; edited by E. F. Cheesman and produced by D. A. Russell, MIMechE. Harleyford Publications Ltd, Letchworth, Herts. Price 45s.

IN its standard "Harborough" format of 11in by 8½in, with a striking yellow cloth cover and dust-jacket and frontispiece colour reproductions, this work adds another to the already excellent series of reference books from this house about aircraft of World War I, and provides yet more valuable information on that primary air conflict.

The main part of the book is devoted to 84 aircraft—three American (none of which saw active service), three Italian, five Austro-Hungarian, 13 French, 29 British, and 31 German. Each receives equal editorial treatment—a half-page column of five half-tone pictures (except only the Fokker Dr.-1 triplane, which has four photographs) alongside the column of descriptive and historical text, with, opposite, a page of three-view drawings to 1:72 scale; there are also fuselage cross-sections at three indicated points and a wing section at one point. Thus the reader finds each aircraft conveniently described, illustrated and drawn on one double spread, there to be studied without turning a page.

No matter how much anyone knows (or thinks he knows) about the aircraft of that period, none can fail to glean many new facts from a close study of these pages. For example, here are the details of the little known Albatros D-XI (with its 160 h.p. rotary engine and geared down half-speed contra-clock airscrew) which did not go into production. Thus the book is far from being confined to the purely "popular" types of aircraft, although these are there, too.

Then we come to the subsidiary section of the book. There are eight pages of narrative and 70 photographs of the history of fighter armament. Camouflage and markings and engine identification receive eight pages of text with 46 photographs. Then follow 107 photographs of rare aircraft, eight most unusual pictures of captured aircraft, 16 of aero engines and 30 of engine installations, cockpit interiors, fuselage skeletons, the forward flight deck of HMS *Furious*, a mechanic swinging a pusher airscrew (a particularly dangerous job), the 1½-Strutter's airbrake, and Guynemer and Plüschow in their cockpits. Nostalgic to me was the picture of an observer handling his free oblique camera from a Nieuport 12. Altogether 703 photographs are reproduced, giving the reader this wide collection for less than a penny apiece. Five double-spreads tabulate dimensions and performance of 163 aircraft, including all in the sections with drawings. The book is arranged so that whoever studies it will scarcely need the index provided, except to find a cross-reference quickly.

Perhaps one should point out that the Aldis tube sight (page 181) was not telescopic, but the whole narrative of armament development deeply interesting. Had the contemporary intelligence service of each side possessed the information here provided the whole conduct of the air war might have been vastly modified with greater (possibly almost decisive) benefit to one or other of the contestants.

One may observe how, from 1914 to 1918, fighter time of climb-to-height was halved, speed and ceiling doubled, fire-power more than quadrupled, fighter bombers developed and used, cannon introduced; and one can then reflect that the *relative* advances in the two world wars may show the greater credit to the earlier war.

NORMAN MACMILLAN

A reduced reproduction of J. D. Carrick's colour frontispiece drawing of S.E.5a pilots fighting a Fokker D-VII on June 17, 1918. This scrap ended with the lone Leutnant Kurt Wüsthoff being shot down and taken prisoner by the French

Straight and Level

TODAY I can reveal the names of the men whom the Minister of Planes, Mr Hugh Strangeways, has appointed as part-time members of the new British Planes Board:—

Sir John Feckless: chairman, East Smithfield Fruit and Linoleum Company; Minister of Football, 1910-12. Aged 87.

J. T. Snoring-Smith: president, Federation of British Bicycle Growers. Formerly works manager, Beetroot Processing Ltd. Aged 89.

Cliff Beat: managing director, Wobble Board Music Industries Ltd. Aged 92.

Sir James Cardboard: chairman, Slothley Bowls and Croquet Club; past president, Leather Distillers Licensing Board. Aged 81.

Dr J. Nit, British air expert (adviser to the Board). Aged 88.

Other appointments, I understand, may be made by the Minister from a number of other suitable candidates now on his department's short list.

I was just settling down to a quiet game of peek-a-boo when I felt the technical editor panting down my neck, muttering hoarsely about variable stators on the GE93 for the B-70. He eventually wrenched himself away to calculate mass flow at Mach 3, but I'm expecting him back shortly

● Retiring in disposition and now, alas, in fact, is Dr A. A. Griffith, chief scientist to Rolls-Royce. "What a shy genius—this man behind jet history," writes John London in the *News Chronicle;* and he is correct in both assessments.

Above all, Dr Griffith is a man of vision, and realization of the jet-lift narrow-delta supersonic transport aeroplane may yet be his apotheosis.

Dr A. A. Griffith's initials stand for Alan Arnold. These names, I find, were taken from a book published in 1895—a book which foretold a giant aircraft described by the author in these terms:

"The air-ship, on which all eyes were now bent with such intense curiosity, was a beautifully-proportioned vessel, built chiefly of some unknown metal, which shone with a brilliant, pale-blue lustre. Her hull was about two hundred feet from stem to stern, not counting a long, ramlike projection which stretched some twenty-five feet in front of the stem."

It is not uninstructive to compare this description with the photograph of a Griffith supersonic delta project appearing on an earlier page.

The author of the book, incidentally, was one George Griffith. He had his son christened Alan Arnold.

● Extract from Sabena's annual report for 1959, page 17, under the heading Assets:—

Flat in Paris . . . Fr. 389,729.

● Bestowing upon Walter Tye, chief technical officer of the Air Registration Board, its distinguished service award, the U.S. Flight Safety Foundation says:

"He combines the excellence of a master technician with a magnificent talent for defining complex air safety problems in terms so clear and simple that they either tend to solve themselves by virtue of his definitions or enable the problems to be considered by a vastly greater number of interested specialists.

"Also his leadership in the development of the objective type of airworthiness requirements tends to stimulate rather than restrict the imagination and skills of aircraft designers in the achievement of greater safety."

Which, to spare Mr Tye's blushes, is quite a compliment to the ARB.

● Did you hear about the club pilot who had to put his bedraggled Tiger Moth down at a mammoth USAF base? His response when required by a formidable member of the Air Police to "Git outa that airplane Buster" was neat and to the point—"*Mach* Buster, *if* you please."

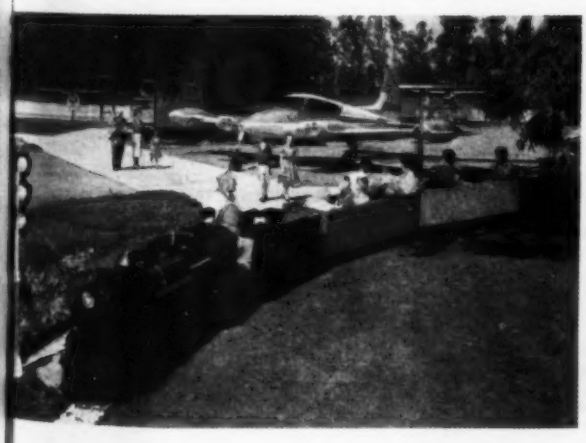
● Pointing out that Prestwick's temperature is slightly higher than that of Renfrew and Abbotsinch, an Ayr County Council report avers: "This is important for jet aircraft, as colder temperatures require a longer run on take-off."

There may be a good many arguments for developing Prestwick as Glasgow's airport, and some of them are well expressed in the council's report. But—forgive me for being clever at someone else's expense—I'm not sure that the argument is too well founded on fact.

● "I do not see any prestige value in running jets unless they are operated by Ceylonese crews. The prestige lies in flying jets with our pilots."—*Mr P. Nadesan, chairman of Air Ceylon.*

● "United Air Lines is now the world's biggest airline without any reservations."

ROGER BACON



The fairyland in my picture is the domain of the Nut Tree Restaurant, midway between San Francisco and Sacramento. So confident were the owners of the future of general aviation that they put down a 1,900ft runway to attract fly-in customers. And they got them. In 1957 4,153 aircraft brought 11,555 customers. Next year there were 6,716 aircraft, bringing 18,805 customers. In 1959 8,734 aircraft and 24,455 customers

Recently off the Lockheed Aircraft production line: the RCAF's first Hercules, expected to go into service later this year

SERVICE AVIATION

Air Force, Naval and Army Flying News

Naval ADC

AN Admiralty announcement last week stated that the Queen had approved the appointment of Admiral Sir Caspar John as her first and principal Naval Aide-de-Camp, in succession to Admiral Sir William Davis. Admiral John has been First Sea Lord and Chief of Naval Staff since May 23 this year. Admiral Davis, who joined the Royal Navy in 1915, has been placed on the retired list.

Fighter Group SASO

A FORMER member of the staff of No 13 Group, Fighter Command (on its formation at the outbreak of war), Air Cdre C. J. Mount has now become its Senior Air Staff Officer. His wartime stay with the group was brief, for in 1940 he returned to flying duties, winning the DFC with No 602 Sqn; later, in the Middle East in 1943/44, he won the DSO when commanding No 104 Sqn on bomber operations. His last two appointments have been at Air Ministry, as Director of Air Plans and then Director of Air Staff (Briefing).

Jungle Operations

AIR support for British troops in the Cameroons (relieving Nigerian troops in advance of the declaration of Nigerian independence on October 1) is being provided by Twin Pioneers of No 230 Sqn, and on Monday of last week an advance party left from London Airport to make preparations for the squadron's arrival in September. The aircraft will be operating from strips, and 230's base is to be at one of them, alongside a track which runs to the seaport town of Victoria, a hundred miles away. The area over which the squadron will fly is described as "mountainous primary jungle." One of its tasks will be conveying perishable supplies.

AVM John Grandy, who is to be C-in-C, RAF Germany from next January (this page, last week)

Nottingham at Tangmere

A SUCCESSFUL example of a university air squadron summer camp was that held by Nottingham UAS at RAF Tangmere, both in flying hours and in the more intangible aspects of such training. Their "task" was 640hr—based on 20hr flying each by 32 students—and in fact 650hr was achieved, despite weather conditions described by the CO, Sqn Ldr H. S. Horth, as "a bit tricky," with cross-winds and thunderstorms. Two of the cadets gained preliminary flying badges and two were awarded instrument ratings.

At the beginning of the camp (July 15), the squadron was dined-in by RAF Tangmere, and before its close (August 16) reciprocated the gesture with a cocktail party. Among Nottingham's visitors were the AOC No 23 Group, AVM C. Scragg, and the Central Flying School basic standards team.

IN BRIEF

Air Chief Marshal Lord Dowding, AOC-in-C Fighter Command during the Battle of Britain, is to take the salute at a march-past on Horse Guards Parade on Sunday, September 18, following the thanksgiving service in Westminster Abbey to mark the 20th anniversary of the battle.

Gp Capt R. W. Hase has been appointed to SHAPE as Chief of the Electronics Branch, Signals Division.

The all ranks reunion and dinner of No XI Sqn, RAF, is being held at the Albert Tavern, Victoria Street, London SW1, on October 8. Tickets may be obtained from the secretary and treasurer, Mr W. L. Wheeler, at 39 Stretten Avenue, Cambridge.

No 115 Sqn, RAF, is holding its 1960 reunion dinner (open to all past and present members of the squadron) at Ye Olde Cock Tavern, Fleet Street, London EC4, at 7 for 7.30 p.m. on Saturday, September 24. Dress: lounge suits. Tickets (price 15s 6d) from P. Williams, 111 Burton Road, London SW9.

The RAAF, which at present operates only fixed-wing aircraft, is to have a helicopter squadron. The AOC Operational Command, AVM V. E. Hancock, said recently that this decision was part of a development plan which included the replacement of Sabres and the equipment of Neptunes with auxiliary jet engines.

Past and present members of No 92 Sqn, which now flies Hunter F.6s from Middleton St George, are invited to attend a squadron reunion at RAF Biggin Hill at 7 p.m. on Friday, September 9, the 20th anniversary of the squadron's arrival there during the Battle of Britain. Those wishing to attend should contact the Adjutant, No 92 Sqn, RAF Middleton St George, Darlington, Co Durham.

HMS "Hermes," which has recently been working-up in the Mediterranean, seen arriving at Messina for a four-day visit

Progress with Sabena's four Caravelle 6s is implicit in this picture of the third aircraft, which has just gained its wings in the Sud factory at Toulouse

AIR COMMERCE

AIR TRANSPORT RULES THE WAVES

FOR the first time in the history of British transport, more people now travel abroad by air than they do by sea. More people now arrive at British airports than the ydo at British seaports. More people now travel between Great Britain and the Continent by air than by sea.

These historic facts emerge from a study of statistics for the first quarter of 1960 published in the August 5 issue of the *Board of Trade Journal*. They emphasize the weighting of the scales in favour of air travel that has taken place since corresponding figures were published for the first quarter of 1959. And while the total number of passengers to and from the United Kingdom has increased by only three per cent over 1959 (had Easter fallen in March instead of April the rise would have been greater) air traffic increased by 23 per cent, while shipping declined by 14 per cent.

This brought the numbers of passengers in the quarter travelling to and from the UK by air to 778,000, for the first time handsomely exceeding the 635,000 who arrived or departed by sea. These statistics must, of course, be reviewed in relation to the fall of Easter, when sea carryings are particularly high on the short crossings to the Continental seaports. This accounted for a fall of sea traffic on Continental routes of 21 per cent, although in the same period there were 23 per cent more passengers by air.

TRAFFIC TO AND FROM GREAT BRITAIN

	Total Passengers in thousands, Jan-Mar		
	1958	1959	1960
Continental			
Sea	352	456	359
Air	377	412	508
Irish Republic			
Sea	169	171	165
Air	64	72	84
Channel Isles			
Sea	11	12	11
Air	33	36	33
Intercontinental			
Sea	102	102	100
Air	113	124	163
All routes			
Sea	635	740	634
Air	486	645	788
Air Traffic as percentage of total traffic			
Continental	52	48	58
Irish Republic	27	30	34
Channel Isles	75	75	75
Intercontinental	53	55	62
All routes	43	47	55

Even the traditional sea route to the Irish Republic felt the impact of air travel this year, the sea share dropping from 2½ times to less than twice that claimed by the air. In contrast, on Channel Islands routes, which normally see three times as many passengers going by air as by sea, total traffic for the quarter fell slightly as a result of Easter occurring in April. Sea and air shared the decline in equal proportions.

After digesting these figures readers may care to recall the controversy which arose after *Flight's* last analysis of Board of Trade travel figures: "Shipping: The Decline Begins," December 11, 1959. This article was reprinted in *Lloyd's List and Shipping Gazette* for December 15 and was replied to a few days later by Mr C. M. Squarey, general manager of Ocean Travel Development. The essence of his letter was that he was not gloomy about the future of shipping, which "is not slipping as much as *Flight* may like to imagine."

Footnote: The Ministry of Transport is to discuss a new scheme for collecting information from holders of British passports who enter and leave the UK on long air routes to and from non-European countries. The information is to be collected on simple cards to show the types and numbers of passengers, and generally to improve statistical knowledge of traffic. A similar simplified scheme will replace the arrangements for acquiring information of sea passengers which, says the Ministry, "have proved burdensome to the shipping companies."

BEA 1959-60

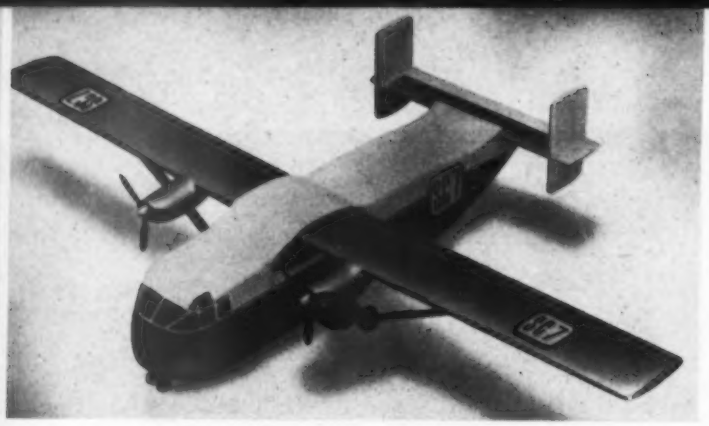
ONCE again BEA has made a net profit, its sixth consecutive surplus, and the highest in the corporation's history. The reasons for BEA's unprecedented success in 1959-60—details of which were due to be published last Wednesday—were essentially twofold: traffic went up 19 per cent and load factor leapt by a remarkable seven percentage points to 67.7 per cent. Of course, revenue did not increase at the same rate as traffic because fares were cut and there was a 3.3 per cent lower revenue rate.

Perhaps the load factor was too high, and some potential customers were turned away. Could BEA have offered more than a cautious 6 per cent increase in capacity? Aircraft and aircrew utilizations went up by small amounts, though both were still less than they were three or more years ago. Indeed, this is where the most scope lies for improvement in BEA's costs. If there is anything in the 1959-60 results to warrant disquiet, it is the increase in BEA's cost level. This item went up by more than three per cent—a relatively sharp increase in a highly sensitive area—to 43.1d per c.t.m.

The cost per c.t.m. of every item of BEA's expenditure except charters either went up or stood still. The figure of 43.1d is the highest since BEA were last in the red, in 1953-54; and the introduction of four new types of aircraft (Comet 4B, Vanguard, Herald and Argosy) is going to make it difficult to keep down this crucial economic index, especially if the Comet 4B's operating cost fails to match that of the aircraft that it is replacing, and even if traffic and load factors continue to be as good as they were in 1959-60.

For six years BEA have enjoyed and reaped the rewards of a stable equipment situation, thanks to the Viscount. Now comes the challenge of re-equipment, and all the pressures on the budget that come with it. No wonder, perhaps, that in presenting his report Lord Douglas had something cautionary to say about supersonics. "We cannot at present see a requirement," he said, "for a supersonic aircraft for the short-haul operations with which we are concerned." The operational problems—ATC, cost and so on—had led BEA to the conclusion that there was "no logical place for a supersonic airliner in Europe in the foreseeable future." But (the old story) "the introduction by others of supersonic travel in Europe might create such competitive pressures as to force BEA into supersonic operations." This, Lord Douglas warned, would be an unfortunate development and BEA would much prefer to see a situation "in which subsonic jets would have an economic life of at least 15 years."

Again, BEA's annual report is a masterpiece, the best in the business by a very wide margin. Stylishly presented and meticulously edited, it is packed with information. It inevitably provokes comparison with BOAC's report; a comparative measure of the amount of information published by each of the two airways corporations may be found in the fact that BEA's report runs to 105 pages, BOAC's to 56. This is in fact the biggest BEA report published to date. It can be obtained from HMSO price 8s.



SKYVAN

First full details of the Short SC.7

UNTIL now discreetly veiled, with no drawings and only basic data released for publication, the Short SC.7—which has been given the name Skyvan—can now be discussed in fuller detail. The makers describe it as the "flying equivalent of the 30cwt van." It will carry "one and a half tons of almost anything," and it can operate at full load from any half-mile field or strip.

The main hold is 6½ft square in cross section and 16½ft long, and a large rear loading door can be opened in flight for supplies dropping. This is raised or lowered manually by a handle from either inside or outside the aircraft.

The payload range curve at the foot of the page shows that with its full 1½ ton payload the SC.7 can fly about 200 miles at 160 m.p.h.; with a one ton payload, it can fly about 900 miles at 140 m.p.h.

Powerplant comprises two Continental GTS 10-520 six-cylinder supercharged and geared piston engines with direct fuel injection driving three-bladed, constant speed, fully feathered Hartzell propellers. It is understood that negotiations are in hand for this American engine to be manufactured by Rolls-Royce in the UK. Total powerplant weight is given as 1,455lb. Airfield performance has been given special consideration, and the diagrams immediately below indicate take-off capability in standard and "hot and high" conditions. The unfactored balanced field length following engine failure during take-off at maximum landing weight varies from 766yd ISA sea level to 1,066yd ISA plus 30°C at 5,000ft. Aspect ratio, wing loading and power loading have been chosen "to ensure a real engine out performance and a sparkling normal climb." At the maximum all-up weight of 8,600lb one-engine-out rate of climb at sea level ISA is 325ft/min, and at ISA plus 30°C and 5,000ft, 188ft/min. A typical rate of climb in standard conditions with both engines is 1,410ft/min, and BCAR sector 2 climb gradient of 2.4 per cent is met at 8,800lb in ISA plus 30 and 5,000ft conditions—200lb above the design maximum weight. In general the SC.7 meets current BCAR normal category "A" requirements.

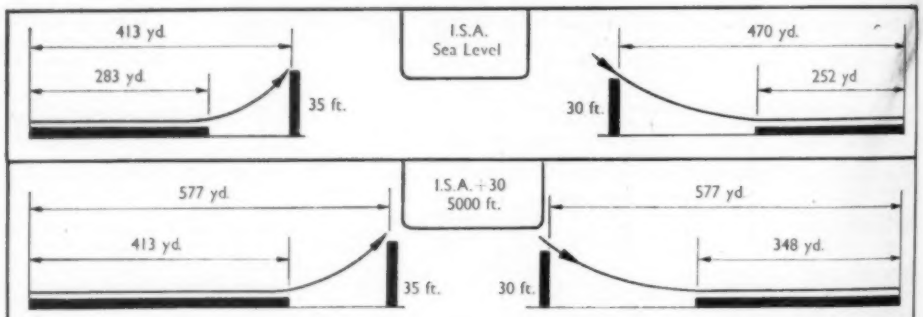
The main fuselage container is truly square and contains no projections or restrictions. The floor is 2ft 2in above the ground and consists of removable stiff panels fitted with combined lashing and seat attachment points. The surface is covered with a chemically inert non-skid layer. If necessary, access to the lashing points can be obtained through side doors at floor level in the fuselage. Floor structure is stressed to 300lb/sq ft in the centre portion (13 sq ft); the remainder is designed to 150lb/sq ft.

Wing design is the outcome of "a very careful optimization" of span, area, taper and section (NACA 634-614). It is 14 per cent thick, with a design lift coefficient of 0.6.

As a passenger transport 15 seats at 38in pitch can be accommodated (see diagram opposite), and if the two forward doors are used for passengers part of the space over the rear loading door can accommodate a toilet, with space available too for a separated food store.

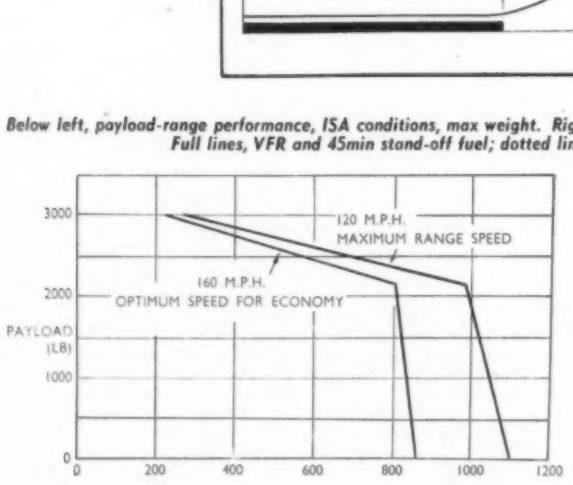
The Skyvan is adaptable to other roles—as an executive transport, flying showroom, air ambulance, agricultural aircraft, vehicle transport, etc. In the last-named role (see diagram) "any known vehicle weighing less than 3,000lb will go into the SC.7"—a useful, if not perhaps commercially practicable, asset. As a military transport palleted loads of up to about 2,800lb and 5ft in height can be parachuted; likewise 12 fully armed paratroops can be carried and dropped.

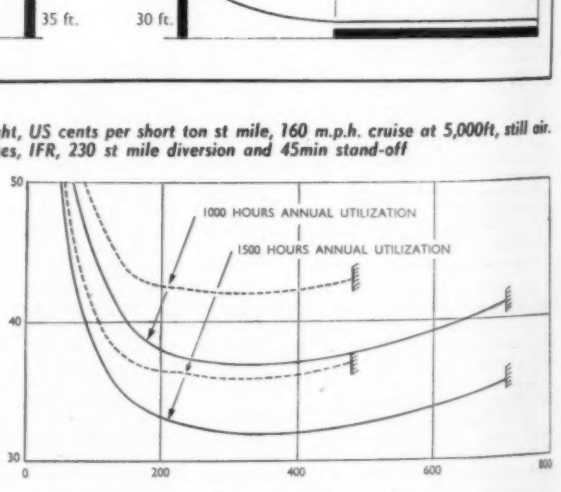
Stalling speed with flaps down is 62 m.p.h. EAS, or 75 m.p.h. clean. Scheduled target threshold speed is 87 m.p.h. EAS, and

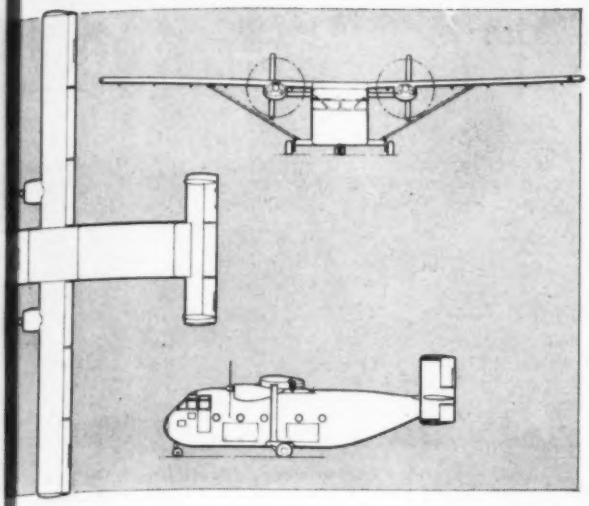


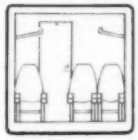
Typical full load, two-engine take-off performance in standard and hot - and - high airfield conditions

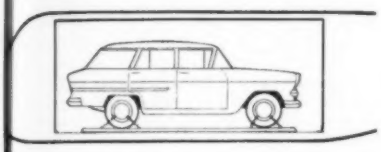
Below left, payload-range performance, ISA conditions, max weight. Right, US cents per short ton st mile, 160 m.p.h. cruise at 5,000ft, still air. Full lines, VFR and 45min stand-off fuel; dotted lines, IFR, 230 st mile diversion and 45min stand-off











Left, general arrangement (for dimensions see below) and sketches showing 15-seat passenger version and accommodation for one car (Vauxhall Victor estate car)

68 m.p.h. at touchdown; and scheduled take-off safety speed is 82 m.p.h.

Almost the entire aircraft is covered with a sandwich comprising a thin corrugated sheet and thin flat sheet bonded together in very large units with Redux. For example, a wing skin from root to tip is a single unit.

Shorts consider that operators will prefer "an aeroplane of proven safe life which can fly for a given time without major structural overhaul or replacements, rather than a 'fail-safe' aeroplane in which the first sign of a fatigue crack may mean primary structural replacements." This has, they say, prompted the design of a safe-life aeroplane, demonstrated as such, based on the fail-safe philosophy.

The flight deck is designed primarily for one-man operation and has generous transparencies. A second seat is provided and there is dual control if required. The flying controls are entirely conventional; the electrical system is a 28V d.c. split busbar circuit, each busbar being fed by one engine-driven generator and one battery. Transistorized inverters provide the small amount of a.c. that is needed. The fuel system comprises a single 150gal glass-cloth fuel tank on top of, and outside, the fuselage. For de-icing the leading edges of the wing and tail unit are fitted with stainless steel sintered distributors with fluid sufficient for two hours' continuous maximum operation. Comprehensive navigation and communications equipment is also provided for.

SHORT SC.7 SKYVAN

Powerplant: Two Continental GTS IO-520 six cylinder supercharged and geared piston engines of 390 h.p. each with direct fuel injection driving three bladed, constant speed, fully feathering Hartzell propellers.

Dimensions: Span, 64ft 1in; length, 38ft 11in; height, 13ft 10.3in; wing area, 373 sq ft.

Weights: Max design take-off, 8,600lb (stressed for 9,000lb); weight less fuel and payload, 5,330lb; structure, 2,697lb.

Payload Accommodation: Main hold volume, 680 cu ft; main hold length, 16ft; main hold height and width, 6½ft; main hold floor area, 104 sq ft.

Fuel Capacity: 150 Imp gal.

Performance: Scheduled cruising speed, 166 m.p.h. EAS; range with max 3,000lb payload and "average" fuel allowances, 115 st miles VFR, 70 miles IFR; range with max fuel (150gal) with 2,200lb payload, 710 miles VFR, 500 miles IFR.

EUROPE'S FOREMOST AIRLINE?

TWO factors dominated the affairs of Air France in 1959: the first was the advent of the Caravelle; the other was the devaluation of the French franc in December 1958.

Although the report is quick to refer to the airline's profit, it is only fair to point out that this was only achieved after provision of substantial State subsidies. These amounted to Fr 3,000 million (£2m) in 1959, being equivalent to three per cent of total commercial revenue. The picture here is that losses appear to be made on all routes other than those to North Africa and to sub-Saharan Africa and Madagascar. The overall results show expenses equivalent to £79 million, against which total revenues were only £77 million (operating revenues amounted to £67 million).

The reason why Air France should persistently lose money is not clear from the report and accounts. Aircraft utilization rates are, as shown below, unusually good. Labour productivity is high; although an annual output of 22,000 c.t.m. per employee is low by North American standards, it is rather better than the average for British and other Continental airlines. Also the utilization of funds is remarkably good, Air France being one of the few leading European carriers which is able to turn its capital over 1½ times in a year. The general appearance of the balance sheet is healthy, with the value of assets standing low in relation to revenues and current assets being substantially larger than current liabilities. Load factors are good and revenue rates are about average. Yet Air France somehow manages to return an average cost level as high as 42 pence per c.t.m., a level exceeded in Europe only by BEA (see page 309). The main nigger in the cost woodpile appears to be that despite above-average labour productivity, salaries and wages are unduly high. A lesser item is the relatively high charge for obsolescence. However, this reflects a prudent fiscal policy which is resulting in the airline's L.1049s being fully depreciated this year and in their L.1649s being fully depreciated by the end of 1961. As for the Boeing 707s and the Caravelles, the airline is setting depreciation periods of eight and seven years respectively, in each case to a residual value of ten per cent.

That the revenue and expenditure figures show increases of the order of a fifth over a period when the business expanded by less than a tenth is indicative of the dramatic effect of devaluation on the Air France economy. Arrival of the Caravelles (which flew 5,700 hours during 1959 at an average daily utilization of 4½ hours) and higher utilization rates on other aircraft fleets raised capacity by seven per cent to 450 million ton-miles. The utilization rates achieved by Air France on their long-haul routes call for special comment: the ten L.1649s and the 22 L.1049s averaged 3,244 and 3,350 hours respectively in 1959. By comparison, their short-haul utilization is less impressive, even by short haul standards.

Traffic rose by eight per cent to bring the overall load-factor from 66 to 67 per cent. The bright star here was a 17 per cent increase in Air France's European traffic, this expansion being directly attributable to the sales success of the Caravelle. Of the European routes, Paris - London is far and away the most important, accounting for about one-quarter of the airline's entire European traffic. The report gives an interesting regional breakdown of Air France passenger traffic. This shows that the total business is divided almost exactly equally into long-haul operation on the one hand and into short- and medium-haul on the other. Of the long-haul traffic, the Atlantic routes account for half, the balance moving on the routes to Asia, West Africa, Equatorial Africa and Madagascar. Of the short- and medium-haul traffic, the routes between metropolitan France and North Africa account for about half, the remainder comprising the domestic and international services on the Continent. An interesting feature of the rapid growth of the international European routes is that last year Air France came very close to overtaking BEA on its short- and medium-haul network (i.e., domestic plus European plus Mediterranean). Recent Air Research Bureau statistics suggest that Air France might well by now have replaced BEA as "Europe's foremost airline." Perhaps this development will allow Air France to drop its absurd claim to be "the world's largest airline"—particularly if United and Capital merge to create an organization three times the size of the French national carrier.

AIR COMMERCE . . .

LEGAL OBJECTION

LEAVING for the United States this week are 800 British lawyers and their families who are to attend the 83rd annual meeting of the American Bar Association. Many of them will be carried on BOAC charter flights to Montreal—a situation which has arisen following the rejection by the CAB of an application to operate directly to Washington. This the Board were completely entitled to do; they endorse IATA's ruling that closed-group charters are restricted to bona fide organizations of less than 15,000 members. The Law Society, which has negotiated the travel arrangements, exceeds this total by 2,000. BOAC had applied to operate 11 charter flights at fares of £86 return for each passenger, but the CAB firmly but politely declined to permit a direct service in contravention of the IATA ruling.

A way around the impasse has been found by operating, with Canadian Air Transport Board permission, into Montreal. From there the lawyers will fly on to Washington by normal scheduled service.

LOCKHEED'S CIVIL AIRCRAFT LOSSES

LOCKHEED Aircraft Corporation's loss in the first half of this year is to be close on £20 million. They are to write off expenditure on the Electra investigations and modifications, development costs on the JetStar, Super Hercules and supersonic transport project, losses on in-traded used aircraft, and a number of other costs in one fell swoop. All this, after tax, represents a grand total of £24 million, but Lockheed is shedding it now in the hope that an unhappy period is over and that a profitable one lies ahead. Robert E. Gross, Lockheed's chairman, has said that he hopes revenue will be about £3½ million in the second half of the year, but even so Lockheed's total loss for 1960 will still be about £16 million.

According to *Aviation Week*, the biggest single item on the debit side of the account has been the development costs and inventory write-downs on the 26 JetStars on order. This amounts to about £11 million. These costs have previously been shown on Lockheed's 1959 annual report as a deferred asset, on the assumption that contracts would eventually be forthcoming. But the USAF's original estimate of a military market for 300 aeroplanes has dwindled into actual orders for only five. Nevertheless, Mr Gross says that he foresees for the JetStar an excellent civil and military market. Future orders will be sold on a book profit basis and development costs are being written off now to clear them out of the way.

The cost of the Electra accident investigations was nearly £½ million and the latest estimate of the modification costs which are expected to result from it is rather over £4 million. Practically all the costs of modification will be paid for by Lockheed; in return Electra operators will waive claims for losses which occurred as a result of the two structural failures or the speed restrictions which were subsequently imposed.

One of the most interesting figures revealed by the chairman is that Lockheed have spent about £430,000 on a supersonic transport. This no longer exists as a project and Lockheed have written off the costs because they believe that if a supersonic airliner is to be built it must be given military, government or industry-wide support.

Another unprofitable project for Lockheed—which a year ago looked very promising—was the Super Hercules. But prospects for it have declined with the "constant erosion of the military transport development market." A turbofan-powered Super Hercules is being proposed, but military inclinations are now more towards big jets than to repowered versions of Lockheed's turboprop.

One sharp lesson has been learned from Lockheed's dark hour: no longer will the corporation do commercial business on the basis of assumptions. The policy of calculating financially on a basis of how many aircraft were expected to be sold is to be formally abandoned. In future development costs will be written off as they are incurred.

Last week nine 5cwt Ford Thames vans were handed over to the Decca Navigator Company for assistance in servicing Decca navigators in aircraft at London Airport. Receiving them from Mr E. R. Lambert, sales director of H. & J. Quick of Manchester is Mr H. B. Capes (left) publicity manager of Decca

STOL ARGOSY?

IT was at the Hanover air show last April that hints were first heard of promising projects by Armstrong Whitworth aimed at developing the Argosy into a freighter with true STOL capability. Now it is reported that one such project would have underwing pods containing Rolls-Royce lifting jets, with normal cruising power provided by two Rolls-Royce Tynes.

An AWA spokesman said last week that very short take-off and landing performance has in fact been foreseen from the outset of the Argosy project; it could be achieved "without the radical alterations that might at first seem necessary," and it had always been known that the original Argosy design allowed for two Tynes in place of four Darts.

Footnote: The five Argosies ordered by Riddle will, according to an arrangement that has been submitted to the CAB for approval, be financed through Atlantic Leasing Corporation, a wholly owned Riddle subsidiary registered in Puerto Rico. The Argosies would be leased to Riddle by Atlantic. According to Riddle the exact amount of the financial payments to Armstrong Whitworth has not yet been determined, but it should be arranged by the end of August.

Unfamiliar to western eyes, these baggage and freight loading vehicles are typical of the lorry-mounted units in service with Aeroflot. The truck lift on the left is a new vehicle which can lift 6 tons to a height of over 14ft in 40-50sec. The conveyor on the baggage loader moves at 2.6ft/sec and is said to be capable of loading 150-200 tons an hour

This picture of Ilyushin Il-18s on the assembly line in a Moscow factory is the first ever to be released of modern Soviet aircraft production. A note on Il-18s for Ghana appears on this page

AIR COMMERCE . . .

Il-18s FOR GHANA?

THE Soviet aircraft industry may have made its first successful entry into the non-communist airline market. In a surprise announcement last week at the handing over of Ghana Airways' New Britannia 309, Mr Krobo Edusei, Minister of Transport and Communications, said that the airline was to take delivery of four Ilyushin Il-18s. He would give no further details, such as delivery date or price, but he said that about 40 Ghanaians would go to Moscow to train as ground crew and air hostesses.

Il-18s have been much in evidence at Accra in recent weeks in connection with Soviet assistance in the UN airlift of supplies and troops to the Congo, and Ghanaian diplomats have also been transported by Il-18—in company with Congolese Government officials—between the Congo and London and New York.

Footnote: An Il-18 crashed in Russia on August 17. On board was the Uganda Nationalist, Mr John Kale, who was being flown from Cairo to Moscow to attend the U-2 trial. The announcement said only that the aircraft caught fire and that all on board died. This is the first record of an Il-18 accident.

KLM TO JOIN SAS AND SWISSAIR?

FOR some months there has been speculation that KLM have been negotiating with SAS and Swissair with a view to joining the Scandinavian/Swissair consortium, which is pooling its DC-8, Caravelle and Convair 600 fleets. Interest in this possibility was renewed last week when Mr J. Van der Weil of KLM said that the Dutch airline would make a decision "before the end of 1960" whether to join the SAS/Swissair consortium "or other existing groups." It will be recalled that KLM decided to withdraw from Air Union.

KLM have already been co-operating with SAS and Swissair in respect of technical and maintenance services on a number of routes.

"QUICKER BY BEA BUS"

FIVE years ago about 45 per cent of the passengers handled by BEA in London reported direct to LAP, while 55 per cent took the BEA bus from the corporation's London air terminal. Today the situation has reversed and more and more passengers are going to the airport by car. But road traffic jams *en route* are now causing so many passengers to miss their flights that BEA have appealed to travel agents to encourage passengers to use the BEA coach service, when they can be sure that their seats on the aircraft are guaranteed. It is, say BEA, "quicker by BEA bus."

BREVITIES

The £1.75m which BOAC agreed in 1958 to lend to Central African Airways over a ten year period may not all be required. CAA's policy, according to the chairman, is to "make ends meet without the assistance of the BOAC revenue before the end of the period."

Ghana Airways (see above) began their first intercontinental services with their own aircraft on August 17 when their new Britannia 309 left London for Accra on a proving flight. It was operated by a Bristol crew. In addition to the Britannia 309 just delivered, Ghana Airways have on order three Viscount 810s for delivery next spring.

September 30 is the date on which Mr James Jeffs, commandant of London Airport, will retire from this post (*Flight*, July 15, page 103). He is to be retained by BOAC on a part-time basis to advise and assist the management at London Airport. In the absence of the chairman or managing director he will be available to escort important passengers on behalf of the corporation, and he may assist also in the organization of Royal flights.

According to a statement issued last week by the Italian Defence Ministry, responsibility for the near miss between a PanAm Boeing 707 and a BEA Viscount in the Rome control zone on August 11 rests with the 707 and not with Rome ATC. The statement said that the 707 had "arbitrarily and excessively approached the corridor reserved for instrument landings." The statement added that both BEA and Pan American had admitted that Rome ATC could in no way be blamed.

The Development Loan Fund in Washington has approved a $3.2m (£1.14m) loan to Ceylon to help finance the construction of an international airport at Katunayake, an RAF staging post until last month.

Pan American are offering seven surplus DC-4s for sale at Frankfurt Airport at a price of Dm. 250,000 (£21,000) each. It is said that one has been sold to Balair to replace the one lost by the Swiss independent in the Sudan.

Lufthansa is likely to propose at the forthcoming IATA traffic conference at Cannes on September 19 that, to simplify the tariff structure, freight rates should be assessed according to the value of the goods as well as weight.

It is reported from Havana that Cubana is to sell two of its five Viscounts as well as three Super Gs. Cubana's Viscount fleet comprises two V.755s and three V.818s. Cubana still has three of its original four Britannia 318s, one having been acquired earlier this year by Eagle Airways.

October 14 is the date set by United Air Lines board for a shareholders' meeting to approve the merger plans with Capital Airlines. The same date has been set for a meeting of Capital shareholders. A condition of the merger is that the CAB shall take action on or before February 1 next.

The first piston engine to have an overhaul life of more than 2,400hr, claims Pratt & Whitney, is the R-2800. Those installed in United Air Lines DC-6s have been approved to run to 2,500hr. The R-2800 is in service with more than 50 airlines and 50 other operators in DC-6 series and Convair liners.

It is reported that the UK independent operator Air Condor is negotiating for the purchase of two DC-4s. The company's fleet comprises a Bristol Wayfarer, a Viking, a Rapide and a Bristol Freighter on lease. It is reported also that Air Safaris are negotiating for the purchase of a fourth Viking, registered G-AJCA.

Swissair has bought British turbine starters for DC-8s and Convair 600s from Auto Diesels of Uxbridge for use at Zurich and Geneva. Named "Aydee," five have already been delivered. The unit is mounted on a Ford FK 1000 van

Rounding the control tower is J. W. Judge in the Archbishop. He finished third in the open handicap "Flight" photograph

Ladies' Day at Thruxton

FIRST WIN FOR THE LINNET

THE races at Thruxton last weekend might be described as a sort of post-Nationals salute to the air racing year. Two longish handicap races and three one-make pylon races in full view of the aerodrome provided more solid air racing entertainment than was to be seen on any one day of the official racing season. There could be no better training ground for some welcome new names to air racing and, most encouragingly, ten girls entered for the ladies' handicap—believed to be the first such long distance event to be held.

A narrow isosceles triangle, the course for the 58-mile handicaps comprised legs of 28 miles, 15 miles and 15 miles between Thruxton, Grove Airfield, Ramsbury Airfield and home. It all started quietly enough, with Joan Short, in the only Turbulent in a mixed field of Jackaroos and Tigers, puttering quietly away downwind. She was followed at intervals by the rest of the field, until all ten girls were round the scatter point and heading away for the marker pole on the disused runways at Grove. Here Joan Short came unstuck, cutting inside the "pylon" and having to accept the inevitable penalty. But already her lead had been whittled down and at Ramsbury Margot McKellar was leading, hotly pursued by Gillian Cazalet. That was the order of finish, with Miss McKellar just in the lead from the yellow Tiger. A correction on start time subsequently reversed the order and Gillian Cazalet notched up her first victory of the day, the Faith Bennett cup.

Compared to the protracted interval between start and finish of the handicaps, the pylon races, in which well-matched one-make aircraft started simultaneously, were immeasurably more entertaining. In the first of these, Dennis Hartas demonstrated how effectively height can be varied to gain maximum benefit from the wind, and on the second of three 6.8 mile laps he worked the maroon and silver G-ACDC into first place to hold it from Miss Cazalet and David Phillips in G-APRA. Beverley Snook tried desperately hard in G-ARAZ but, like Janet Ferguson behind him, could not find the necessary extra knots.

The Turbulent event provided a contrast in cornering styles, Norman Jones finding a tight turn to be more effective than Joan Short's gentle ones in whittling down the distance that separated them on the first lap. He got the King's Cup winner G-ANZZ (now back to near-standard form) into second place on lap 2, but could make no impression on the King's Cup runner-up G-APZZ flown by Ian Trethewy. Waugh's slower aircraft brought up the field.

Sheila Scott established a most commanding win over Read, Ramsay-Smith and Gush's Jackaroos in the last of the pylon events, winning from Read by 25sec. There was a sensation at the start when Miss Scott diced off the deck in an alarming turn, and Parry's race ended when he nosed-over on opening up.

In the open handicap, last event of the day, a seemingly impossible task faced Vivian Bellamy in the Hampshire Aeroplane Club's lovely Spitfire 8. When he took off, 28min 32sec behind Waugh's leading Turbulent, the first aircraft was already crossing Ramsbury with only 15 miles to go to the finish. The progress of the race was in doubt until the final minutes, partly because of the difficulty of the observers at the country pylons in spotting competitors' numbers. When the leaders came into sight, the Spitfire had only just reached Ramsbury and, over the hedge, it seemed a comfortable first win for David Phillips and the British-built Linnet, notwithstanding that he had hit a bird with his spinner. But as he crossed the line, the Spitfire snarled down upon him, failing by less than one second to snatch the lead. Judge and Hartas were close up, but the back workers trailed far, far behind. After a promising start the Arrow Active had suffered a defective magneto and arrived only when the field had landed, and it was a quarter of an hour later when the last, lost Turbulent came into view. A good race to crown the day, marred by only one non-starter—Peter Masefield's Chipmunk which, after all-night work at Wisley, was prevented from taking off by an anti-noise ban on Sunday flying.

OPEN HANDICAP

Start Order	Pilot	Aircraft	Regn.	Posn.
1	E. Waugh	Turbulent	G-APIZ	—
2	I. Trethewey	Turbulent	G-APZZ	—
3	P. Gush	Jackaroo	G-AOEX	13
4	R. Croysdill	Jackaroo	G-AOIX	14
5	P. Barber	Jackaroo	G-APAO	15
5	H. Jackson	Tiger Moth	G-AMBI	12
7	B. Snook	Tiger Moth	G-ARAZ	5
8	T. Parry	Tiger Moth	G-AOJJ	10
8	D. Hartas	Tiger Moth	G-ACDC	4
10	J. Harris	Tiger Moth	G-AOCV	9
11	Miss C. Cazalet	Tiger Moth	G-ANPK	6
11	Miss S. Scott	Jackaroo	G-APAM	11
13	J. Stewart-Wood	Auster V	G-AIKE	7
14	J. W. Judge	Tiger Moth	G-ANZZ	3
15	D. Phillips	Linnet	G-APNS	1
16	C. N. Bishop	Arrow Active	G-ABVE	—
17	P. Dawson	Proctor 3	G-ANZJ	8
18	V. Bellamy	Spitfire	G-AIDN	2

LADIES' HANDICAP

Start Order	Pilot	Aircraft	Regn.	Posn.
1	Joan Short	Turbulent	G-APIZ	—
2	Beryl Saunders	Jackaroo	G-AOEX	8
3	Margot McKellar	Tiger Moth	G-APRA	2
4	Frankie Kane	Tiger Moth	G-AMBI	6
5	Janet Ferguson	Tiger Moth	G-ARAZ	3
6	Zita Padden	Tiger Moth	G-AOJJ	5
7	Margot Torrens	Jackaroo	G-APAO	9
8	Jill Cook	Tiger Moth	G-AOCV	7
9	Sheila Scott	Jackaroo	G-APAM	4
10	Gillian Cazalet	Tiger Moth	G-ANPK	1

A field of Tigers, Jackaroos and Turbulents was enlivened by two entrants of sharply contrasting appearance—the Hampshire Aeroplane Club's Spitfire 8 and the Tiger Club's Arrow Active "Flight" photograph

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Let's be Fair to the Hurricane

IN the current flood of books and newspaper articles on who won or lost the Battle of Britain, little has emerged that gives new light on that classic air battle, but one fallacy is being quoted so frequently as to run the risk of becoming accepted as historical fact: this is the question of the comparative performance of the Hurricane.

In the two latest references, Alexander McKee's *Strike from the Sky*, and Kurt Tank's biography, much space is given to emphasizing the relative inferiority of the Hurricane (and even, to a lesser extent, the Spitfire) to the Bf109. Galland also sneers at the Hurricane while admitting the superior manœuvrability of the Spitfire.

Now let us get the record straight. To one who was privileged to fly throughout the Battles of France and Britain in Hurricanes, and who subsequently flew both the Spitfire and the Bf109, the following impressions remain completely clear and unchanged.

The Hurricane I with c.s. aircrew was a magnificent fighting machine, with excellent qualities of gun-platform stability, manœuvrability up to 20,000ft, ruggedness and ease of control in take-off and landing. In climb and level speed it was slightly slower than the 109 (but no more than 20-30 m.p.h.), which meant that it was not always easy to get away from a 109—but that was not the object of the exercise. Once in combat the Hurricane could easily out-manœuvre the 109. Above 20,000ft the 109 was better; but when correctly employed against the bomber formations and close escorts below 20,000ft the Hurricane was magnificent for the task. When in September 1940 there was talk in my squadron (No 87) of replacement by Spitfires there was nearly a riot—if our Hurricanes were inferior, no one had told us about it! This tremendous spirit and confidence in their aircraft was typical of Hurricane squadrons at that time.

In direct comparison I found that the Hurricane could out-turn Spitfires I and II at low and medium altitude, and could very easily do this to the Bf109. When flying the latter subsequently I was impressed by the very restricted vision in all directions from the cockpit, and by the extremely heavy longitudinal control characteristics in the dive. I formed the impression that with the exception of the 109's slight edge in speed and climb performance we had had the benefit of quality in every way.

It is simply not true to say, as is now often implied, that the Battle of Britain was won not only against superior odds (which was true), but also in spite of inferior equipment. It is perhaps significant that none of the criticisms of the Hurricane in this context that one has read has been written by a Hurricane pilot.

The Luftwaffe fighter arm very definitely did not have a technical lead in 1940, and credit for the victory must be shared between the Royal Air Force and those responsible for the conception, design, construction and testing of the world's two best fighter aircraft in 1940, the Hurricane and the Spitfire.

West Clandon, Surrey — ROLAND BEAMONT

[Wg Cdr R. P. Beamont, DSO, OBE, DFC, is a special director of English Electric Aviation Ltd and is their chief test pilot. This month he was additionally appointed deputy chief test pilot of British Aircraft Corporation.—Ed]

Unwanted Farthings Wanted

From AVM Sir John W. Cordingley, KCB, CBE, RAF(Retd).

WITH the current level of prices, few people will miss the estimated 200 million farthings that are to be withdrawn from circulation. We at the RAF Benevolent Fund know a great deal about the rise in the cost of living that has made this tiny coin an anachronism. It is also one of the factors causing us to spend about £1,400 a day on relief of distress among serving and ex-Service personnel.

I therefore suggest that your readers might care to send their now useless farthings to us [at 67 Portland Place, London W1] so that we can cash them in and put the money to good use in this year that marks the 20th anniversary of the Battle of Britain.

London W1 — JOHN W. CORDINGLEY, Controller, RAF Benevolent Fund

Light-aircraft Delivery to NZ

WITH reference to the letter [August 12] under the title "Light-aircraft Delivery to NZ," I hesitate to set out to correct my old friend Bill Shackleton in his most emphatic statement in the last paragraph of his letter, but in 1936 Jean Batten bought a Percival Gull and flew it from England to New Zealand ("the whole way") that same year. Jean is a New Zealander and delivered her aircraft home. The fact that later she brought it away again from there is probably beside the point.

If Jean's was not considered to be the first delivery flight to NZ, of any aircraft irrespective of size ("the whole way"), then Mr Ernle Clark is entitled to the claim. He bought his Percival Gull in 1936 at about the same time as did Jean and delivered it home to NZ ("the whole way") about two weeks after Jean Batten's flight. There can be no dispute about this being a delivery flight because, like Jean, Ernle Clark is a New Zealander and kept his aircraft in that country.

Incidentally, the first two aircraft ever to fly from England to New Zealand were Percival Gulls—the two flights mentioned above, in 1936. Great credit indeed is due to the two pilots concerned.

London W1 — EDGAR PERCIVAL

HOW interesting and pleasing to note that we have "stirred it up" with regard to the Apache that we sold to the Canterbury, New Zealand, Aero Club and delivered there. It appears that we are wrong! Not to worry, though; every time there is a first, someone cleverly reveals that there was a first before *him*. I have a feeling that there must be individuals who go round record-seeking for the express purpose of keeping it a secret until somebody else does it, and then nip in smartly and knock the wind out of his hydraulic system. Anyway, well done Capt Bradshaw, and full marks—he deserves them, doing it in a Proctor—and he's welcome to it, too!

I feel, however, that any flight of this distance by light aircraft is worthy of mention, in particular when they are normal sales delivery flights as opposed to acts of adventure!

Our chief pilot, Capt Peter Nock, who did this trip, is having a quiet chuckle about it all, though the situation was somewhat tense when, having passed through "some of the worst weather experienced" *en route* for Norfolk Island (5 miles by 3 miles in the middle of 1,200 miles of unpleasant Tasman Sea) the pendulous system in the compass leapt off its mounts and jammed some 400 miles out from Norfolk Island. Weather conditions were so bad in the westerly direction that return to Australia with an unserviceable compass was out of the question. From here on the sun was used and bearings taken on the wind-lanes on the sea surface against the forecast wind.

Some 250 miles out from Norfolk Island, Bill Lear's ADF-14 worked wonders by picking up the Norfolk Island beacon. This little instrument was 100 per cent reliable and homed the Apache all the way. The remainder of the trip was somewhat simpler.

We are at least sure that it was the first *Apache* delivered from the UK to New Zealand, and even surer that it was the first Apache delivered there by *us*; but, we hope, not the last.

London SW1 — KEITH E. JOHNSTONE, R. K. Dundas Ltd

Historical Accuracy

I SUPPORT Roger Bacon's criticism of the accuracy of aviation information (*Flight*, July 22, page 126). The majority of books on aviation, particularly those which cover early history, contain errors of fact which are repeated by other writers.

The Spandau guns of German aircraft of 1914-1918 are a good example. In an effort to set the record straight may I suggest that all recorders and writers of fiction use the term "Maxim" when referring to the fixed guns of German fighters of that period? I refer to the Maxim Model 08/15 7.92 mm machine gun as modified for synchronizing. This appears to be the gun most used for fixed installations; movable guns for use by observers were usually Parabellums.

Incidentally, the Maxim 08/15 was manufactured at the Spandau arsenal near Berlin.

London NW2 — L. F. E. COOMBS

FORTHCOMING EVENTS

Aug. 27. Luton Flying Club Display, Luton Airport.
Aug. 28. Oxford Aeroplane Club At Home, Kidlington.
Aug. 28-Sept. 4. Czech Aero Club: World Aerobatic Championships.
Aug. 31. Kronfeld Club: Lectures on the Coventry and London National Gliding Weeks.
Sept. 3-5. French and Savoy Aero Clubs: International Centenary Rally, Aix-les-Bains.
Sept. 4. Wolverhampton Aero Club At Home.
Sept. 5-11. SBAC Display and Exhibition, Farnborough.
Sept. 7. Kronfeld Club: "To over 25,000ft," by Flt Lt G. Rondel and Plt Off I. Strachan.
Sept. 8-12. AGARD and Instituto Lombardo di Scienze e Lettere: Seminar on Propulsion for Astronautics, Varenna.
Sept. 9-12. Popular Flying Association Rally, Cranfield.
Sept. 11. International Landing Contest, St Nicholas Maes.
Sept. 12-16. Institute of the Aeronautical Sciences: Second International Congress, Zurich.
Sept. 12-18. Battle of Britain Week.
Sept. 14. Kronfeld Club: Film of German World Championships, by John Furlong.
Sept. 21. Kronfeld Club: "Flying in the US Nationals," by Philip Wills.
Sept. 25. Milan Aero Club: Helicopter Rally.
Sept. 28. Kronfeld Club: Meteorological Discussion.
Sept. 26-Oct. 1. AGARD Structures and Materials Panel Meeting, Athens.

THE JETSTART

A foolproof and economical stand-by ground starting unit

WITH the advent of large jet aircraft many manufacturers have devoted much effort to the development of improved forms of ground starting unit. These embrace several distinct families of equipment. Some supply electric power, generated by rotating machinery driven by a diesel engine or other prime mover. Electric current from storage batteries is rare, but an increasing proportion of ground starter units supply compressed air, and here again the group can be sub-divided into those which provide a continuous flow (from a compressor driven by a prime mover or by bleed from a gas turbine, for example) and those which provide a limited supply from storage bottles.

The numbers of starts possible from a stored-air starter is dependent entirely on the bottle capacity, and in this respect they are clearly not intended to effect a large number of starts in quick succession. On the other hand they have the advantages of being far cheaper and much more reliable than other starters, and require virtually no maintenance.

Long renowned as manufacturers of a wide range of equipment for handling all forms of air, gases and liquids in a very wide industrial field, I.V. Pressure Controllers Ltd., of 683 London Road, Isleworth, Middlesex, have had experience in the design and development of stored-air starter units for aircraft and marine engines, dating back to early experiments in the starting of the Armstrong Siddeley Pythons installed in the Lancaster flying test bed. Following this they produced a starter for the Python-Wyvern which was adopted by the Royal Navy, and which has since been used for starting the Vulcan B.2 during its flight test programme.

The latest development is the "Jetstart" Trolley which in itself is capable of providing all air services to an aircraft. The panels and circuit are so arranged that they may be used for tyre inflation, servicing oleo systems charging aircraft containers, slowly turning over the engines for servicing and, of course, for starting engines.

There are two versions of this equipment. The Mk 4 contains 12 air bottles with a total volume of 10.5 cu ft. The total capacity of air contained at 3,600lb/sq in is 2,570 cu ft at NTP. Besides the main line air-starter supply there is a low-pressure supply panel delivering at 5 to 750lb/sq in gauge and a high-pressure supply panel delivering up to a max bottle pressure of 3,600lb/sq in gauge. The overall dimensions are: height, 54in; length, 85in; and width, 52in; charged weight is 2,300lb and the towing speed is 15 m.p.h. The Jetstart Mk 5 is a 24-bottle version of the Mk 4 giving a working capacity of air of something exceeding 4,000 cu ft of free air delivered at NTP. The flow rate of the main-line air-starting supply is up to 130lb/min, controllable at pressures between 5 and 150lb/sq in. The overall dimensions are: height, 60in; length, 100in; and width 60in; and the weight charged is approximately 5,200lb. In addition to these two units I. V. Pressure also manufactures a portable packaged unit comprising the same valve system as a Jetstart unit but intended for use with a customer's own source of high-pressure air.

The Jetstart units are simple, towable trolleys mounted on four wheels and complete with steering and braking systems. The bottles are charged to a maximum of 3,600lb/sq in and the valve system enables this pressure to be reduced and controlled to very fine limits before discharging through a hose connected to the pneumatic-starter circuit of the aircraft or to any of a variety of other services which may be required. Experience has shown that once the bottles have been charged the unit may be safely left for very long periods with no maintenance whatsoever. There are no moving parts so there is practically nothing that can go wrong. The operation of the unit is simplicity in itself and a single demonstration is sufficient even for a non-technical operator. There can be danger from air-filled hoses, for when the operation has been successfully completed, the air in the hose is automatically vented to atmosphere and the main supply valve is closed. Provision is made for simple charging of the bottles by any type of compressor and for the draining of any condensate.

Owing to the limited number of starts available without recharging—the number depends entirely on the bottle capacity and the average engine starting time—it is not claimed that these units are suitable to replace day-to-day gas-turbine starters; but as emergency or stand-by starters they provide a very cheap insurance against failure, and since they are virtually maintenance-free, they are particularly suited to provide engine starting and servicing facilities in servicing bays, maintenance hangars, and staging posts—or indeed wherever one may find the need to crew-service jet aircraft.

Although many modern aircraft have self-contained starting systems, and most airlines maintain their own electrical or air supply vehicles at major points on their route network, it is still not unknown for a large jet transport to be held up due to the fact that it cannot be started. This is a very expensive business which can be avoided for a very modest outlay on a Jetstart trolley.

One of the first Jetstart was used by PanAm at London Airport for starting Boeing 707s; in five months of continuous use it performed faultlessly, and was prevented from becoming standard equipment only by the fact that the operator's central engineering staff at Miami had already chosen an American unit. Eventually this particular Jetstart was bought by BOAC for their 707 fleet, pending the delivery of Mk 5 Jetstarts. BEA have also adopted the Jetstart for the support of their Comet fleet. These units are being used for engine starting, for motoring the engines during maintenance operations and for the charging of internal air bottles and pumping up tyres. In the military field the Jetstart would by now be standard equipment throughout the USAF, Europe, and NATO air forces had not the Air Materiel Command voted against the purchase of non-American equipment. The one series of tests which was held involved the starting of a North American F-100D of the 20th Tactical Fighter Wing at Wethersfield. It was generally agreed that practically nothing could go wrong with the Jetstart and—a vital consideration in modern nuclear warfare—that it could virtually guarantee a start when all other units might be unserviceable at the critical moment.

INDUSTRY IN BRIEF

R. J. Richardson & Sons Ltd, of Commercial Street, Birmingham 1, have formed a new division under the title of Site Shotblasting (Great Britain). The new branch will undertake on-site cleaning, by the shot-blasting process, of equipment too large to be transported to the company's works.

Sciaky Electric Welding Machines Ltd have announced the commercial availability of a new type four-channel spot-welder control, of the fully synchronous digital type. It is claimed to eliminate transience and to give a considerable reduction in power demand. Named "Synchro Spot," the unit is suitable for use with any spot or projection welder.

Two brochures have been produced describing Benelex 70, an industrial laminate made by the Masonite Corporation of Chicago. Among its applications are rubber press tools and jigs, fixtures and chucks. Benelex 70 can now be obtained in the UK from Mosses & Mitchell Ltd, 60 Ironmonger Row, London, EC1 (tel Clerkenwell 4731/2921), who can also fabricate the material.

Production of specialized equipment has now been transferred from the Ekco Electronics Ltd factory at Southend-on-Sea to the new factory at Ashingdon Road, Rochford, and the company's electronics installation and service department has also moved in. Production of radar and associated equipment will shortly be transferred to Rochford from Malmesbury so that the whole electronics production enterprise will be centralized. Total area of the first stage of the new factory is about 44,500 sq ft and work has already begun on the second stage on the 13-acre site.

Assembly of de Havilland Sea Vixen flap jacks in the recently opened "clean room" of Lockheed Precision Products Ltd at Speke. The new room has a floor space of 3,000 sq ft